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## ON DYEING.

[*Continued from page 273.*]

THE colors denominated by dyers *simple*, because they are the foundation of all the other processes, are four; namely, first, *blue;* second, *yellow;* third, *red;* fourth, *black.* To these they usually add a fifth, under the name of *root*, or *brown* color.

### IV. ON DYEING BLUE.

The principal coloring matters employed in dyeing blue, are *indigo* and *woad.*

*Indigo* is undoubtedly the oldest vegetable coloring matter known, though it was introduced into Europe so late only as the sixteenth century. Pliny mentions a color, which was obtained from India, and which, on that account, was called *indicum.* There is scarcely any doubt, but that this was our indigo.

The commercial world is supplied with indigo from Manilla, Batavia, Bengal, and Isle de France; likewise from Lima, and Guatimala, from most parts and ports in the province of Caraccas, from St. Domingo, from New Orleans, and from South Carolina. Of all these sources, Guatimala, Bengal and Caraccas are the most abundant, and their quality vastly superior.

Indigo is a blue powder, extracted from a plant called Anil, or the Indigo-plant. According to the experiments of Chevrault, a French chemist, it exists *in the plant*, chiefly in the state of a *white fecula*, which becomes *blue* as it absorbs oxygen. By deprivation of part of its oxygen, which is termed "*stringing*" by the dyers, it assumes a green color, which turns again blue by the reabsorption of the necessary quantity of oxygen.

Indigo has a very strong affinity for wool, silk, cotton and linen. Every kind of cloth, therefore, may be dyed with it, without the assistance of any mordant whatever. The color thus induced, is very permanent; because the indigo is always saturated with oxygen, and because it is not liable to be decomposed by those substances, to the action of which, the cloth is exposed. It is not affected by acids or alkalies in common use, whilst astringents and iron make no stains; through time, however, it gets lighter by washing and air.

The only *direct* solvent of indigo is sulphuric acid, and the solution thus obtained, is known by the name of sulphate of indigo. Wool and silk are often dyed blue by this substance; but it can scarcely be applied to cotton and linen, because the affinity of these substances for indigo, is not great enough to enable them readily to decompose the sulphate. The color given by sulphate of indigo is exceedingly beautiful; it is known by the name of Saxon blue, and derives probably its brilliancy from the larger quantity of oxygen which the indigo takes from the sulphuric acid.

The best proportions in the preparation of the sulphate of indigo, appear to be those chosen by Poerner, namely, one part of indigo and four parts of concentrated sulphuric acid; to the solution one part of dry carbonate of potash is to be added, and then it is to be diluted with eight times its weight of water.—The cloth must be boiled for an hour, in a solution containing five parts of alum, and three of tartar, for every thirty-two parts of cloth. It is then to be thrown into the water-bath, containing a greater or smaller proportion of the diluted sulphate of indigo, according to the shade which the cloth is intended to receive. In this bath it must be boiled till it has acquired the wished for color.

The alum and tartar are not intended to act as mordants, but to facilitate the decomposition of the sulphate of indigo. The alkali added to the sulphate, answers the same purpose. These substances also, by saturating part of the sulphuric acid, serve in some measure to prevent the texture of the cloth from being injured by the action of the acid, which is very apt to happen in this process.

But sulphate of indigo is by no means the only solution of that pigment employed in dyeing. By far the most common method is, to deprive indigo of the oxygen, to which it owes its blue color, and thus to reduce it to the state of green fecula; and then to dissolve it in water by means of alkalies, or alkaline earths, which in that state act upon it very readily.

Two different methods are employed for this purpose. The first of these methods is, to mix with indigo a solution of some substance which has a stronger affinity for oxygen than the green basis of indigo: green oxyde of iron, for instance, and different metallic sulphurets. If therefore, indigo, lime, and green sulphate of iron, be mixed together in water, the indigo gradually loses its blue color, becomes green, and is dissolved; while the green oxyde of iron is converted into the red oxyde. The manner in which these changes take place is obvious; part of the lime decomposes the sulphate of iron; the green oxyde, the instant that it is set at liberty, attracts oxygen from the indigo, decomposes it, and reduces it to the state of green fecula. This green fecula is immediately dissolved by the action of the rest of the lime.

The second method is, to mix the indigo in water with certain vegetable substances, which readily undergo fermentation. During this fermentation, the indigo is deprived of its oxygen, and dissolved by means of quicklime or alkali, which is added to the solution. The first of these methods is usually followed in dyeing cotton and linen; the second, in dyeing wool and silk.

The first method is used in the following manner by the dyers of cotton-goods, whose pieces are generally from 24 to 28 yards long, and 6-4ths to 9-8ths wide—Having two vats, each 6 feet deep, $3\frac{1}{2}$ wide, and 6 long, with a light frame to go easily out and in, and two slides on the two sides to move up and

down with hooks on the slides, and on each side of the frame on which they can be fastened by the two selvages at the bottom and top of the piece; take eight pounds of good indigo well ground. Boil each pound with two of potash in one gallon of water for two hours, and then put it in the vat, which you mean to work as your dyeing vat, having previously charged it with water; add four pounds of stone-lime, newly slaked, to each pound of indigo, stir it up well, and put two pounds of copperas to each pound of indigo; stir it well again, let it settle 24 hours, when it ought to be fit to work. According to the shade of blue required, add or diminish your indigo, keeping the same proportions of lime and copperas, with often stirring up, until you have exhausted your indigo. The other vat, which is filled with pure water, is to dip the piece with the frame in and out, as soon as it is taken from the former one, by which means the color is rendered regular and level, that is, even and free from stains: for the liquor of the dyeing vat, when it first receives the air, fixes itself on the piece, and in taking it out of the vat, runs from the top selvage to the bottom one, and acquires oxygen from the air: thus the bottom selvage would, without that caution, become darker than the top; but this irregularity of color is prevented by the water-vat, as the piece is plunged into it immediately on its being taken out of the indigo vat; by which means the superabundant coloring matter that but slightly adheres to the goods, is washed off. For dark blues, the water-vat may be dispensed with, as the marks caused by the running of the color are not discovered; but for the light blues it is indispensable.

The cloth ought to remain in the liquor one hour at least, so that it may penetrate well. The liquor at the same time ought to be so strong, that the color may be obtained with only one or two dips; because the longer the pieces are in the liquor, the better the coloring matter will penetrate into the interior of the thread, while, on the other hand, the oftener it is dipped and exposed to the air, the more it is liable to be spread on the surface of the cloth in small particles, and to fall off by wear, by washing or friction.

After blues are taken out of the water-vat, they are generally run through a cold liquor, composed of water and sulphuric acid, so sour, that it imparts to the mouth the taste of lemon-juice. This is to remove the iron or alkali which the piece may have taken up in the vat; it also destroys the greenish tinge, and makes it appear of a brighter blue, by imparting an additional quantity of oxygen. The goods are then well rinsed out of this sour liquor, and washed in a little hot water, which tastes slightly of alum; this also assists the fixity of the color.

According to an observation of Haussman, not only copperas but likewise any other precipitate of iron, formed by means of an alkali, is equally proper to the solution of indigo, as long as the iron is not saturated with a maximum of oxygen.

The method of deoxidizing indigo, as practised by the calico-printers, for their pencilling blue, is as follows: Take one ounce of good indigo, half an ounce of yellow sulphuret of arsenic [orpiment], half a pound of pearl-ashes, and half a pound of lime. Mix the lime and ashes together, let them settle, take off the clear ley, boil it to the strength and quantity of caustic ley that you want, then put in the indigo, boil it one hour, take it off the fire, let it cool, aud then stir in the orpiment; lastly thicken it with gum arabic, according to the purpose for which it is wanted.

This mode, though excellent in itself, cannot be practised, however, but in pencilling; for were it put upon the block for printing, from the exposure of such a surface to the atmosphere as would be necessary, it would most rapidly acquire oxygen and become blue, before being applied to the cloth, and then its particles being enlarged, would lay on the surface and be washed off. The strength of the caustic alkali would likewise injure the printing blocks. When the printers use the block in printing blue, they print on the indigo, finely ground, mixed with gum, to make it work freely, then dry it. Two vats ought to be ready, similar to those above mentioned, each filled with water; with as much copperas in the one, and in the other as much lime, as the water in each vat will take up; a frame must also be in readiness, like that described above, in which the piece is hooked. The goods are put in the lime vat, and then the cop-

peras vat alternately, till the copperas and lime have deoxidized the indigo on the cloth sufficiently to give it the highest degree of fixity. This is what the printers call their China blue; it is rather inclined to pale blue, but very durable.

In the second method of dissolving indigo by mixing it in water with vegetable substances, which rapidly undergo fermentation, woad and bran are commonly employed as vegetable ferments, and lime as the solvent of the green base of the indigo.

The fermentative substances deprive the indigo of part of its oxygen, and as soon as this takes place, it is dissolved by the linen and unites with the coloring matter of the woad. Both are forming one coloring liquid which appears blue or of a copperish color on the surface where it can combine with oxygen, but which underneath presents an uniform green mass. As long as the vat preserves this green color, it is proper for dyeing. When the cloth is first taken out of the vat, it is of a green color; but it soon becomes blue by attracting oxygen from the air. It ought to be carefully washed, to carry off the uncombined particles. The solution of indigo is liable to two inconveniences; first, it is apt to run sometimes too fast into the putrid fermentation; this may be known by the putrid vapors which it exhales, and by the disappearing of the green color.—In this state it would soon destroy the indigo altogether. The inconvenience is remedied by adding more lime, which has the property of moderating the putrescent tendency. Secondly, the fermentation sometimes goes on too languidly. This defect is remedied by adding more bran or woad, in order to diminish the proportion of quicklime.

There are other indigo vats without the addition of woad, but they all agree in the circumstance, that by means of some vegetable or animal ferment the indigo is deprived of its oxygen, and then dissolved by lime or vegetable alkali: The vat with woad is used for the dyeing of wool. *Silk* is dyed light blue by a ferment of six parts of bran, six of indigo, six of potash, and one of madder. To dye it of a dark blue, it must previously receive what is called a ground color; archil is used for this purpose.

*Cotton* and *linen* are dyed blue by a solution of one part of indigo, one part of green sulphate of iron, and two parts of quicklime.

*Woad*, which we have already mentioned as being frequently used in addition to indigo, is the produce of the Isatis tinctoria, a plant which is cultivated in several parts of Europe, and a native of those countries.* It is sold in common for the use of the dyer in the state of a powder, which, like indigo, contains a coloring fecula though in a smaller quantity. This powder, however, gives only brownish tinctures of different shades to water, to alcohol, to ammonia, and to fixed alkaline lixivia; rubbed on paper it communicates a green stain. On diluting the powder with boiling water, and after standing for some hours in a close vessel, adding about one-twentieth its weight of lime newly slaked, digesting in a gentle warmth, and stirring the whole together every three or four hours, a new fermentation begins; a blue froth rises to the surface, and the liquor, though it appears itself of a reddish color, dyes woollen of a green, which, like the green from indigo, changes in the air to a blue. This is one of the nicest processes in the art of dyeing, which has been carried of late years to a high degree of perfection in France, where the high price of indigo during the present war, has rendered this substitute of the greatest importance. The colors now obtained by the French dyers from woad are not inferior to those obtained from indigo, either in brilliancy or even in durability.

Several other vegetable substances have been proposed for dyeing blue. The fruit of the *Genipa Americana*, Linn. a native of Guyana and of the Brazils, the capsules of the *wild woad*, or *isatis sylvestris*, the berries of the *randia aculeata*, Linn. and several other similar products are known to furnish permanent blue colors. But the scarcity of some of these materials and the inferiority of others to those already in use, will perhaps yet for a long time preclude their introduction into the art of dyeing.

* The preparation of woad for dyeing as practised in France, is minutely described by Astruc, in his *Memoirs for a natural history of Languedoc*. Interesting details on the same subject may be found in *Dr. Mease's Archives of Useful Knowledge*. Vol. III, p. 58. 169.

### OF DYEING YELLOW.

The principal coloring matters for dyeing yellow are weld, fustic, quercitron bark and hickory-bark.

*Weld* or *woald* [reseda luteola, Linn.] is a plant cultivated in many parts of Europe. Two sorts of it are distinguished; the bastard or wild, which grows naturally in the fields, and the cultivated, the stalks of which are smaller, and not so high.—For dyeing, the latter is preferred, as abounding more in coloring matter. The more slender the stalk, the more it is valued. It is sold in common in dried bundles. It abounds in the western counties of Pennsylvania, where five crops are annually produced, instead of two crops which that plant yields in England; the fecula is also much richer here than in England.

*Fustic* or *yellow wood* [morus tinctoria] is a native of the West-Indies. It affords much yellow coloring matter, which is very permanent.

The inner bark of the quercus tinctoria, known commonly, though improperly, under the name of *black oak*, has been introduced into the art of dyeing by Dr. Bancroft, under the name of quercitron bark. It grows in almost all parts of the United States in rich soils, and always removed from the sea. The color produced by it is of great beauty and in times of peace a large quantity of the powdered bark is annually exported from this country to Europe.

The inner bark of the various kinds of *hickory*, or juglans alba, affords likewise a beautiful yellow dye; but the quantity of coloring matter contained in it, is one-third less. Some varieties furnish a yellow which comes still nearer to woad than that obtained from quercitron bark. The long sharp-pointed hickory, *juglans alba acuminata*, furnishes a pure lemon-yellow; the pig-hickory, *juglans alba minima*, a yellow more entire, but less beautiful, and the balsam-hickory, *juglans alba odorata*, a yellow fully saturated and very lively.

Many other plants peculiar to the United States might be used advantageously for the extraction of yellow dyes. On the Osage, the Arkansas, the Red river and other places west of the Mississippi, grows a beautiful tree called *bois jaune* or yel-

low wood or by some mock-orange on account of the external appearance of its fruit. The color of the wood is of a brilliant yellow. The Indians use it for dyeing yellow feathers, hair, &c. after having cut it into small pieces and boiled it in water. It seems to require no mordant.

The root of the *hydrastis canadensis* affords a fine yellow dye, and is frequently employed by the Indians for that purpose. The *Coreopsis lanceolata* of the southern states, also dyes a beautiful yellow. We confess, that we are unacquainted with the popular names of both plants. To these we may add the *Xanthorissa apiifolia*, or *tinctoria*, *shrub-yellow root*, a plant of North Carolina, but which we have met with also on the banks of the Ohio.* The stem and root are of a bright yellow color, and the decoction of them imparts a drab color to cloth, and a handsome yellow to silk; but the dye will not take on cotton or linen. In this country it may be very usefully employed in Morocco manufactories, for the dyeing of leather.

Yellow coloring matters have too weak an affinity for cloth, to produce permanent colors without the use of mordants. Cloth, therefore, before it is dyed yellow, is always prepared by combining some mordant or other with it. The mordant most commonly employed for this purpose is alum. Oxide of tin is sometimes used when very fine yellows are wanting. Tan is often employed as a subsidiary to alumine, and in order to fix it more copiously on cotton and linen. Tartar is also used as auxiliary to brighten the color; and muriate of soda, [common salt] sulphate of lime, and even sulphate of iron, in order to render the shade deeper. The yellow dyed by means of fustic is more permanent, but not so beautiful as that given by woad or quercitron. As it is permanent and not injured by acids; it is often used in dyeing compound colors, where a yellow is required; the mordant is alum. When the mordant is oxide of iron, fustic dyes a good permanent drab color.

Woad, quercitron bark and hickory bark, yield nearly the same kind of color; but as the bark yields coloring matter in

* Dr. Woodhouse has given an excellent account of this valuable plant in the fifth volume of the Medical Repository of New-York.

much greater abundance, it is, added to its extreme cheapness in this country, much more convenient than woad. With us, it has already superseded the use of this plant. The method of using each of these dye-stuffs is nearly the same.

Wool may be dyed yellow by the following process; let it be boiled for an hour or more with about 1-6th of its weight of alum, dissolved in a sufficient quantity of water. It is then to be plunged, without being rinsed, into a bath of warm water, containing in it as much quercitron or hickory bark as equals the weight of the alum employed as a mordant. The cloth is then to be turned through the boiling liquid, till it has acquired the intended color. Then a quantity of clean powdered chalk, equal to the hundredth part of the weight of the cloth, is to be stirred in, and the operation of dyeing continued for eight or ten minutes longer. By this method, recommended by Dr. Bancroft, a pretty deep and lively yellow may be given fully as permanent as woad yellow.

For very bright orange or golden yellow, it is necessary to have recourse to the oxide of tin as a mordant.

For producing bright golden yellows, some alum must be added along with the tin.

In order to give the yellow that delicate green shade so much admired for certain purposes, tartar must be added in different proportions, according to the shade. This kind of color will be most easily produced with hickory bark.

By adding a small proportion of cochineal, the color may be raised to a fine orange or even an aurora.

*Silk* may be dyed different shades of yellow, by quercitron or hickory bark. The proportion should be from one to two parts of bark to twelve parts of silk, according to the shade required. The bark tied up in a bag should be put into the dyeing vessel, while the water which it contains is cold; and when it has acquired the heat of about 100°, the silk having been previously alumed, should be dipped in, and continued till it assumes the wished for color. When the shade is required to be deep, a little chalk or pearl-ash should be added towards the end of the operation.

*Cotton* and *linen* are dyed yellow as follows; The mordant should be acetite of alumine, prepared by dissolving one part of acetite of lead, and three parts of alum, in a sufficient quantity of water. The solution should be heated to the temperature of 100°, the cloth should be soaked in it for two hours, then wrung out and dried. The soaking in the acetite of alumine may be again repeated, and if the shade of yellow is required to be very bright and durable, the ultimate wetting with lime water, and soaking in the mordant may be repeated three or four times.

By this contrivance, a sufficient quantity of alumine is combined with the cloth, and the combination is rendered more permanent by the addition of some lime. The dyeing bath is prepared by putting 12 or 18 parts of quercitron bark [according to the depth of the shade required,] tied up in a bag, into a sufficient quantity of cold water. Into this bath the cloth is to be put, and turned round in it for an hour, while its temperature is gradually raised to about 120°; it is then to be brought to a boiling heat, and the cloth to remain in it after that only a few minutes. If it be kept long at a boiling heat, the yellow acquires a shade of brown.

Nankeen yellow is obtained by a solution of the red sulphate of iron, which is combined with the cloth by carbonate of potash.

*(To be continued.)*

## ON BRICK-MAKING.

IN a country whose prosperity is rapidly progressing, and where villages, towns and cities are created as by the enchanting wand of the magician, the articles employed for building cannot be considered as a matter destitute of importance. In the present state of our society, *brick* appears to deserve in every respect a decided preference over every other material. By its means we may construct edifices at cheap rates, in almost every situation, without the expense of carrying stone from remote quarries; and it is likely, that these compositions, if pro-

perly made, would prove superior in durability to any natural stone. The streets in Holland are every where paved with a hard kind of brick not much more liable to be injured than the stones commonly made use of; and the houses of Amsterdam appear to be not at all decayed, but are perfectly fresh, as if new, though many of them have stood at least two centuries. The spirit of improvement may perhaps effect in this country, what the stimulus of necessity has done on that naturally poor spot.

The art of brick making consists in the following operations: 1, the proper choice of the clay; 2, the preparation of the clay; 3, the moulding of the bricks; 4, the drying, and 5, the burning.

1. *Choice of the clay.* Common clay is scarcely ever found in a state approaching to purity on the surface of the earth. It usually contains a large proportion of siliceous earth, and frequently oxyde of iron and lime. The blue or red color of brick clay is commonly owing to the presence of iron; in blue clay this metal exists in a lower degree of oxydation, but by burning it will combine with the necessary quantity of oxygen to convert it into red oxyde; hence the red color of bricks, whether they are made with the one or the other kind of clay. The most advantageous proportion of the sand to the clay for the fabrication of bricks is about eighty six of the former to fourteen of the latter in one hundred parts. A clay in which the proportion of sand is much smaller, is unfit for bricks, as being disposed to separate into clefts; it is technically called a *fat* clay. If the proportion of sand be much greater, the clay has scarcely sufficient tenacity; this is called a *meagre* clay. The presence of lime gives origin to calcareous clay, or *marles*, which are often the fittest materials for making bricks as they are very liable to vitrify in a high degree of heat and to acquire by this means all the hardness of stone-ware. The first endeavor of the brickmaker ought then to be to examine the nature of the clay which he means to employ. This is commonly done in a rough way by the manufacturers, but the following process is more precise, and at the same time easy and expeditious. Nitric or muriatic acid poured upon unburnt clay

detects the presence of lime, by producing an effervescence. In the next place, a lump of clay, of a given weight, is to be diffused in water by agitation. The sand will subside, and the clay remain suspended. Other washings of the residue will carry off some clay, and by due management in this way, the sand or quartzose matter, may be had separate. Nitric acid, by digestion will take up the lime from a part of the clay previously weighed, and this may be precipitated by volatile alkali. The clay, the sand and the lime may thus be well enough ascertained by weight, so as to indicate the quantity of sand or other material requisite to be added, in order to form that compound, which, from other experiments, may have been found best adapted to produce good bricks. An examination with the microscope will shew whether the sand contains feldspar, or other stones of a known figure.

II. *The preparation of the clay.* Bricks are frequently made with clay newly dug. This practice, however, is highly injurious to the durability of this article; the bricks in this case are light, full of cracks and spongy. To prevent these inconveniences, the clay should be dug two or three years before it is used, and during that interval, frequently besprinkled with water, and turned with a spade. This operation is called *mellowing.* In many places six months are supposed to be sufficient for the tempering and mellowing of the clay. The season most commonly chosen in this case is the autumn, as it is thought that the clay is essentially benefitted by the frosts of the winter. The theory of the mellowing the clay, however, is not very clear. Mr. Kirwan supposed, that alumine or the earth of clay retained moisture with great obstinacy when not combined with carbonic acid; that the long exposure to the air, together with the frequent turning, slashing, &c. favored this combination, and rendered thus the clay more tough and more ductile. Whatever may be the cause, the effect is undeniable, and bricks treated in this manner are much superior to others in solidity, smoothness, hardness and durability.

When thus mellowed, the clay may be dug in pits, each pit being one foot deep, four feet wide, and sixteen feet long, which makes a mass for one thousand bricks. In this state it is left to

soak in water some days. It is then to be tempered and wrought into a smooth paste, with as little water as possible. This is sometimes done by a horse-mill. All the stones ought to be picked out, but this is seldom done; at the same time, if the analysis and experience have shewn that there is a deficiency of sand in the clay, this article is added. In its stead the fine cinders collected from ash-pits and passed through a sieve, may be substituted to the sand with advantage in coal countries. It is then cut, slashed, and worked with a spade into heaps of about six feet by ten feet in compass, a mass sufficient to make 2,000 brick; water is then thrown upon it and permitted to remain for 24 hours, when it is tempered, and skirted all round, patted together and sprinkled lightly with water, smoothed neatly over with a spade, keeping the mass tight and compact, and finally covered with boards, cloths or bushes, to prevent the injurious effects of the sun and air. It is then ready for the moulder.

III. *Moulding of the bricks.* This operation is performed at Philadelphia in the following manner: At day dawn, the wheeler, with his barrow running on a platform or barrow-way, comes to the prepared mass, and loading his barrow, carries it to the table of the moulder, patting it in with a spade tight and compact. The moulds used in making every brick for building purposes, are commonly ten inches in length and four and one half in breadth. The moulder takes this mould with his left hand, and a parcel of earth in his right, from a tub placed at his left side, and sprinkles or rubs it over the table; he then cuts down with his two hands finger end to finger end, enough of the clay to make a brick and an half; this is called a *walk;* then forming the mass into a shape somewhat of the mould, by first drawing it towards him, then pushing it from him, and again drawing it towards him, he forms the clay into the mould, so as to fill the corners, and strikes off the superfluous clay with an instrument called a plane, which is a steel plate about 1-8th or 1-10th of an inch thick, 8 inches long, 5 wide, with a handle near the end. When the mould is filled, the bearer takes it away and delivers the clay therefrom in regular order on the floor, making 44 rows, and 53 bricks along. He then returns to the table for another, and in coming back he scrapes out one end and a side

of the mould: the next time he reverses the mould, and cleans the other end and other side; the scraper is made of hickory, and is attached to his right side by a string, but not hanging lower than the knee, otherwise it will drag on the next row when he stoops to lay down the bricks. Immediately after the rows are finished, the bricks are turned upon their edges, and if a welt be found upon the under side, it is removed by rubbing the *flat* of the hand over it. For very nice brick a knife is used to remove the welt.

IV. *Drying of the bricks.* The bricks having thus received their shape, are removed after ten or fifteen minutes to a board shed 21 feet long, where they are hacked, that is, piled up on edge, so that one brick is made to stand with a small angle on two others, the farther end standing on two, and the nearer end on one. This part of the business is divided among the gang, each one turning and hacking 600 brick, and taking care to leave the breadth of the middle finger between each brick. The courses amount to 16 or 20, but for beginners 17 will be enough. The courses are reversed, to favor the passage of the air through them. It is highly requisite that the bricks forming the first ten courses should be well dried, otherwise they will be crushed by the weight of those above them. The bricks remain in the shed until the kiln is ready, and care is taken to keep out all moisture. When ready, the bricks are carried by one or two gangs to the kiln; the boys loading the barrows, the wheeler and temperer wheeling all and tossing them to the moulder who sets them in the kiln.

V. *Burning of the bricks.* In the vicinity of London the bricks to be burnt are commonly built up into large square heaps, called clams, stratified with fuel between the rows, and leaving room for the fire to play between the bricks. Two or more arches likewise, according to the size of the clam, are formed at the bottom, for holding the fuel, and kindling the fires. In this way it is obvious the bricks cannot be uniformly burnt; on this account the method of burning bricks in kilns is generally preferred in the United States. The setting of the bricks for this purpose, is an important part of the business, and is commonly performed in the following manner:

The object is so to place the bricks as to permit the free passage of the fire through them; and for this purpose the moulder beginning at the back of the kiln, runs up seven straight courses forming a part of the falling of the arch, setting the bricks on edge. To ensure the accurate arrangement of these courses, a straight edged board, called a ruler, about four inches wide, is run in from the external holes, and reaches across the kiln; this board is placed an inch and a half back from the sides of the kiln holes, and against the edge of this board the bottom course is set. The bricks in the third and seventh courses are set tight, or close; but those in the other courses are set a finger breadth from one another. This vacancy is essential.

The setter then begins to overspan, that is, to form the arch, by placing the bricks so, that every course of bricks may extend one inch and a half beyond the course immediately below it, for five courses in height, taking care to *skintle* well behind, that is, to back up or fill up with brick against the overspanners.

The next seven courses on the opposite side of the arch, being then set as before; the setter again begins to overspan five courses to meet the overspanning on the opposite sides, thus forming the arch. This is called the rounding, and is a nice and important operation. The two first courses may be set with safety, but of the last three which close the arch, ten bricks only must be set at a time, *one on two* to meet the top courses of the overspannings; if more were set, the overspanners not being supported on the back will cause the arch to fall in. The middle brick is then run up as soon as possible as high as the rounding, viz. 14 courses, the setter taking care to have the heads of the middle brick tight against the ends of the roundings. When the setter has so far proceeded, he sets four bricks end against end, (technically four nine inches) and then proceeds to set the kiln to the intended height, by the rule of three bricks upon three reversing each course, keeping the heads of the bricks tight against each other. Care must be taken, not to set his intended height without the middle brick being up against the rounding. Thus the setter proceeds until the kiln is full; observing to make each hole alike.

The top course is covered with brick placed flat, and so disposed that one brick covers part of three others. This process is called platting.

The kiln being full of bricks, wood is put in the kiln holes, and set on fire in order to dry the bricks gradually and equally. The wood is put on an iron bar placed across the kiln holes and raised about three inches from the ground, to increase the current of air. In about three days and three nights, the top of the kiln must be examined, in order to see whether the *fire is up*, that is, whether it has reached the top of the kiln; if so, the smoke (called water smoke) will change from a light to a black hue; the roof is then taken off, the fire is pushed, and a strong regular red heat attentively kept up from 48 to 60 hours more; care must be taken not to choke the holes, or the draught will be prevented, the bottom course will be partially burnt, and the fire will not work through. The heat must not be so strong as to be white, for the bricks will then melt or drop. At the end of the time just mentioned, the kiln will be found to have sunk about 9 inches; but the shrinking will depend on the nature of the clay, and after one or two burnings the sinking of the kiln will pretty accurately determine when the bricks are sufficiently burnt. Satisfaction having been obtained on this point, all the holes must be closed up with brick, and daubed over with wet sandy loam, so as carefully to exclude the air, for four or five days; at the end of which the *pistoing* is to be opened, the *platting* piled on the walls, and the bricks regularly taken down. From 50 to 60 cords of wood are consumed at the burning of 140,000 brick. Split wood is used inside of the kiln, but that under the wall may be round.

There are seven kiln holes in each end; all two feet high, and 16 inches wide, with fire stone heads outside. The inner stone of the kiln hole, is laid one foot higher than the outside stone, in order to give the kiln a draught, and not to confine the wood under the wall. The distance between each kiln hole is the length of three bricks and two inches. The height of the kiln is commonly 23 feet, giving room for 35 or 36 courses. The average width in the clear is 28 feet, and each kiln contains about 140,000 bricks. The bottom of the kiln must be lev-

cl. In Philadelphia, they are paved with brick having the flat side down. The mouth of the kiln (called the *fistoing*) is ten feet wide. When the kiln is full, this is closed with a wall commonly of nine inches of brick, set on edge, the whole height of the work, and daubed with a sandy loam mixed with water, as tight as possible; but it is better to build the wall three bricks and a half thick from top to bottom, in order to diminish the risk of its cracking, and to retain the heat. In walls of such a thickness, two stout props should be placed at each corner of the kiln, at the distance of a brick and a half from the corner of the side walls. The side props ought not to be so thick; but they must not bend, when the pressure arising from the expansion of the kiln tosses them out. The external cover of the kiln consists of boards, and is supported by props.

The excellence of bricks consists chiefly in the first operation; for bricks made of good earth, and well tempered, become solid and ponderous, and will take up a longer time in drying and burning than the common bricks seem to require. Good bricks are easily known by their clear sound and by their striking fire with steel, the color is of much less importance.

In manufacturing countries, where many furnaces for steam engines, the melting of metals and other purposes, are erected, the preparation of good *fire-bricks* is an object by no means indifferent. It is requisite that these bricks should neither shrink nor melt by exposure to any high degree of heat. A clay, consequently, is chosen, which contains no lime and as little iron as possible, because these two substances will easily vitrify along with alumine or the earth of clay. Fire clay ought at the same time to contain a large proportion of sand as preventing shrinkage. The latter, however, may be added in the necessary proportion. Old bricks which have been long exposed to a high degree of heat, and ground to a coarse powder, may be substituted to sand with advantage. In England, fire-bricks are commonly made with Stourbridge clay, which contains very little lime or iron. The bricks made with it very readily produce sparks when struck by steel, and their internal appearance is altogether not very unlike the soft white granite of Cornwall, except that they are of a yellow color. In the vicinity of Pittsburgh

the best fire clay is obtained in the neighborhood of Beavertown on the Ohio. It is a dark bluish clay which burns white at a high temperature. In this case the dark color is not owing to iron, but to the presence of coaly matter which burns off on the outside, whilst that contained in the inside contributes to render the bricks made with it better non-conductors of heat. It contains almost no lime, and it may be remarked on this occasion in a general manner, that the clay which is found *below* the strata of coal, is commonly free from that substance.

## APHORISMS OF POLITICAL ECONOMY.

[*Continued from p.* 292]

### CHAP. II.

### ON THE FUNCTIONS OF THE PRECIOUS METALS, UNDER THE FORM OF COIN, IN THE POLITICAL ECONOMY OF MODERN NATIONS.

¶ 88. The introduction of the precious metals under the form of coin, into the political economy of agricultural and manufacturing nations, has produced a general revolution in the manner of living of these nations. Not only it has furnished those who were beforehand in possession of these metals, with the means of exempting themselves from any labor, but it has placed likewise the agricultural and manufacturing classes of the society in the disadvantageous situation of rendering them incapable of providing any longer for their wants *in an immediate manner* by their labor. Obliged as they were from this moment to exchange their merchandise for money before they could supply their wants, their situation became necessarily more uncertain and precarious.

¶ 89. These necessary consequences, however, of the introduction of precious metals under the form of coin, did not essentially change the political economy of the agricultural and manufacturing nations, as all purchases and sales did still continue to be founded on the equality of exchanges. Only, the precious metals under the form of money became from this mo-

ment the active principle of the political economy of these nations, as it will appear from the following paragraphs.

¶ 90. There are in every political society no other *real* sellers but the cultivators of the soil and the manufacturers, because the merchants are in fact nothing more but mediators of sales and purchases. But the wants of life impose upon all the individuals of a nation the necessity to be purchasers. And as he who purchases a merchandise to apply it to his own wants, is called a consumer, we may say, that all the individuals of an agricultural and manufacturing nation are *consumers*.

¶ 91. To multiply the exchanges between the various classes of society is nothing more but to multiply continually their consumption. And as consumption takes place only by the exchange of money for the productions of nature or art, it is evident, that the continual multiplication of exchanges which gives birth to the progressive prosperity of a nation rests finally on the multiplication of the precious metals under the form of money.

¶ 92. All the consumers of an agricultural and manufacturing nation may be divided into two classes, namely, the independent and the dependent consumers. The first are those who are capable of becoming purchasers without wanting to be sellers; and the second, on the other hand, are those who have become purchasers only after having been sellers. It is evident, that to the first class belong all those who are possessed beforehand of money, and whom we might call *absolute consumers*, whilst the second class is entirely formed by the cultivators of the soil and the manufacturers, because it is only after having exchanged the produce of their labor for money, that they can become consumers.

¶ 93. Three principles follow from the relations established in the preceding paragraph:

1, That the consumption of the agricultural and manufacturing classes supposes the previous consumption of the absolute consumers.

2, That the actual consumption of the absolute consumers becomes the measure of the possible consumption of the cultivators of the soil and the manufacturers.

3, That the consumption of the absolute consumers determines the general consumption.

¶ 94. But as the general consumption consists in the total amount of exchanges made between all the classes of society, and as the advances of a nation in their prosperity are measured by the total amount of exchanges, it is evident that this prosperity will always be in a direct proportion with the consumption of the absolute consumers.

¶ 95. Thus any variation that a nation may experience in the consumption of their absolute consumers, must likewise produce an equal variation in the consumption of the agricultural and manufacturing classes, and consequently in the prosperity of the whole nation.

¶ 96. According to these principles an agricultural nation will find themselves in a progressive course of prosperity only when their absolute consumers will increase their consumption. They will decline, on the contrary, remain stationary or retrogade in these progresses when their absolute consumers will decline, remain stationary, or retrogade in their consumption.

¶ 97. In the natural course of things, the absolute consumers will extend their annual consumption to the full proportion of the precious metals under the form of money, which they will be capable of devoting to this purpose. In order to multiply their consumption it is consequently sufficient to multiply continually in their hands the precious metals under the form of money, and this consumption of the absolute consumers will exercise the most salutary action on that of the two other classes of society.

¶ 98. Such then, is the importance of the precious metals under the form of money, that without their continual multiplication in the hands of the absolute consumers, it is impossible, that an agricultural and manufacturing nation should make any advances in their prosperity. This truth ought to teach those into whose hands the administration of a commonwealth is entrusted, that they will undermine the very foundations of the prosperity of their people, not only by impoverishing the class of the absolute consumers, but also by opposing obstacles of any kind to their free consumption.

*(To be continued.)*

# REVIEW.

*History of the Expedition under the command of Captains Lewis and Clarke to the sources of the Missouri, thence across the Rocky Mountains and down the river Columbia to the Pacific Ocean, performed during the years* 1804–5–6. *By order of the government of the United States. Prepared for the press by Paul Allen, esq. Philadelphia,* 1814. 2 *Vols.* 8*vo.*

A WORK which has been long announced, long promised and long desired, appears before the public under the most unfavorable circumstances. It creates in us sensations somewhat similar to those which we receive from a long avenue leading to a distant pile. Our expectations of what we are to see, are raised at every step, and before we have yet reached the purposed goal, our imagination has completed a wondrous picture, to which, alas! we find no equivalent, when finally we are permitted to view reality. Such will have been probably the feelings of many readers who have taken up this long postponed publication, and such, to a certain degree, were our own sensations. But let not disappointment bias our judgment, let us examine calmly and dispassionately what we ought to have reasonably expected, what has been really done, and what is the final result of an expedition undertaken under the especial authority of the government of the United States, for the promotion of national prosperity.

A party of twenty-eight men under the command of two military chiefs receive orders from the President of the United States to ascend to the sources of the Missouri, to cross the Rocky Mountains, and to descend by the waters of the Columbia to the shores of the Pacific Ocean, in order to explore these widely extended regions. They are instructed to examine closely all the water-courses, to determine the latitude and longitude of the most remarkable situations, to inquire into the names and numbers of the Indian tribes, their languages, habits, customs, civil and political institutions, to direct their attention to the soil and face of the country, and to describe the cli-

mate and the natural productions. Thus, a further extension of geographical knowledge in general and a more particular acquaintance with the various natural and political resources of those extensive countries either possessed by or nearly connected with the United States were essentially contemplated. Though provided with every thing that could ensure the success of the expedition, they soon found how numberless are the difficulties and the dangers to be overcome at every step in such an attempt. The rapid current of a mighty river is to be stemmed; wide rafts, formed by the collection of trees closely matted together present an obstacle to navigation, and the current, irritated by these interruptions, rushes round them with great violence and force. The undaunted boatsman, however, advances in such situations only by means of grapling hooks and the laborious tow-line. There sawyers, or stumps of trees, standing erect under the water, threaten to cleave the unwary boat and to plunge the adventurers into a watery grave. Elsewhere the falling in of impending banks presents a not less dreadful image of destruction. Thunder-storms, or violent gushes of rain will frequently oblige the voyagers to lay in under circumstances and in places where safety is but precarious. The daily food must be wrested together with life, by the daring hunter from the shaggy buffaloe, the timid deer, the antlered elk and the fleet antelope; he returns often from his toilsome exercise with all the stings of hunger without any means of satisfying it, and his comrades, anxiously waiting for his return, read in the dejection of his looks that the labor of his day has been lost. Or, perhaps he has met with a wild bear, the dreadful tyrant of the wilderness, and if he has not fallen a victim to the sanguinary monster, he has been saved only by his dexterity or by his cunning. But man himself presents frequently to the traveller a foe not less dreadful than the wild beasts of the forest; to the barbarian a stranger is an enemy; the friendship of the savage is always obtained with difficulty, preserved only with care, and never enjoyed with perfect security. Even the rest of night has its pains and its torments. A dry and healthy situation cannot be always chosen for encampment, and the stings of thousands of musquitoes, or other insects, will chase balmy

sleep from every eye. The toils and difficulties are still increasing, when rivers are to be ascended or descended as they flow through a hilly and mountainous country. Ripples and falls oppose in this case, an almost insuperable obstacle to navigation, and if by dint of perseverance and labor the boats can stem the rapid torrent, the goods with which they are charged, at least, must be unloaded and carried by land over a tedious portage. The travellers will be soon unable to proceed any more by water. The stings of the prickly-pear which inflict painful wounds to the feet must be disregarded, the huge mountain must be ascended, the steep rock must be climbed, every step must be chosen with caution, and still the most wary will be hurled occasionally into the open abyss along with an overwhelming mass of falling rocks and stones. The horse, that obedient companion of his way, has left the wanderer in the trackless desert, or if still the latter solicits his assistance, he sees him fall down and expire before his eyes. In vain the eye searches here for grazing herds of buffaloe, elk, deer, and antelope; they have fled from the barren waste; the gun has ceased to secure the means of procuring subsistence; some dried provisions, some scanty roots, or perhaps the flesh of the last faithful horse are the only supplies to maintain a miserable existence. Bartering with the Indian tribes offers but insufficient resources to the despairing; poor, and starving themselves, what could they give? Besides, the stock of merchandise for bartering is daily diminishing; a portion has been spent in former traffic, another has been lost on the way or destroyed by the numberless accidents on the route. The party descend now into the open plains; but here the landscape is no more enlivened with the foliage of thick and massy woods which give shelter to the wild animals. Widely extensive prairies harbor only a few birds and quadrupeds of a smaller kind whose lean frame used as food, is but little proper to restore the powers of life exhausted by fatigue and hunger. The fishes of the rivers and the roots of the earth which both supply the scanty food of the natives, have become soon the almost only supporters of an existence, which is often ready to sink under the burthen of so much accumulated misery. Sickness presents itself under the most hideous form in the

inhospitable wilderness; the friendly aid of the physician, the fostering cares of relations are far off, whilst the party are marching on, and it is perhaps the effort only, roused by absolute necessity, that will save the life of the patient. They finally arrive at the end of their wishes, though not of their labors. The wide ocean expands itself before their eyes, but its shores offer no shelter to the weary. The heavy surge threatens to overwhelm men and goods, and it is only with difficulty that they find a spot where they may bide in safety the storms of the winter. Their privations continue in the meanwhile, new enemies under the form of vermin assail them, their stock of merchandise is almost exhausted, and the cunning Indian is not willing to part with his provisions without what appears to him a full equivalent. One cheering hope, however, is left to the unhappy adventurers. Vessels from several European establishments are frequently visiting the coast for the sake of trade. If, during their stay in these remote regions, any one of them should appear, they are sure to obtain sufficient means to return with some comfort to their native country. They are waiting with anxiety, but no ship comes in sight; the season, meanwhile, is advancing, they have to recross the mountains immediately after the melting of the snow, as any longer delay commits their safety. Thus they are forced to undergo a second time, the same circle of aggravated privations, hardships and difficulties, which, however, are overcome by the most persevering courage. These sufferings are not confined only to the private soldiers who compose the party; the commanding leaders participate with them many of the toils and all the privations of the expedition. In many of the excursions which they undertake from their encampments, in order to explore the course of rivers, or the nature of the country, they are particularly exposed to the most gnawing pains of hunger and fatigue, and more than once their frame is ready to sink under disease. While thus suffering under bodily pains, their mind is incessantly engaged in providing for the wants and the security of their companions; they are deeply afflicted with the idea of their deplorable condition and the rank which they enjoy ex-

poses them only to the severe pangs of feeling the wretchedness of all, united to their own wretchedness.

That men thus situated should still be capable of exerting the powers of their mind in scientific and philosophical researches, appears almost incredible. The faculty of observation, to shew itself in all its vigor, requires essentially, ease, comfort and tranquility. We have, nevertheless, before us, a mass of information, which, if it does not fully satisfy the curiosity of the philosophical and political enquirer, presents him nevertheless, with numerous and valuable riches. The geography of an extensive tract, almost entirely unknown before, has been investigated and minutely described; the prospects which these regions offer to future settlements are sufficiently ascertained; some advances, at least, have been made in the knowledge of the most convenient roads, which, in a more advanced period of our population, may connect the eastern part of the North American continent with its western portion, and by which the riches of the Atlantic shores may be perhaps conveyed to those of the Pacific Ocean. New animals, new plants, new minerals are offered to our curiosity, and perhaps to the useful enjoyments of future generations, and human nature, such as it exists among the Indian tribes, is displayed in a series of interesting pictures. There is, indeed, nothing in the work that can excite wonder and astonishment, or carry along the reader by the charm of an increasing interest. The scenes of the wilderness are cheerless and monotonous, as those of savage life are more or less uniform. The flippant reader, and perhaps likewise the man of taste, might have wished the suppression of many details which are equally lost for our information and our entertainment. But let us not forget, that the work before us is the *official* report of public men to their employers, in which they might think it necessary to be minute not only in the relation of their observations, but also in that of their conduct and of their measures. After all, this minuteness of detail, added to the absolute want of flights of imagination, and even of traits of sensibility, give to the performance a stamp of candor and veracity, which, in the eyes of the philosopher, are the very first requisites of similar compositions.

Our readers will not expect that we should follow the party in the long course of geographical discovery. The indication of places and situations would become almost unintelligible without the aid of a map. We shall only express in this respect our regret, that captains Lewis and Clarke, in the route taken by them across the Rocky mountains, were induced to make a very bad choice. We are informed by Mr. H. M. Brackenridge, in his valuable Views of Louisiana, that Mr. Henry, a member of the Missouri Company, and his hunters, discovered several passes, not only very practicable, but even in their present state, less difficult than those of the Allegheny mountains. These are considerably south of the Jefferson river. It is the opinion of the gentleman last mentioned, that loaded horses, or even wagons, might, in its present state, go in the course of six or eight days, from a navigable point on the Columbia, to one on the waters of the Missouri, rendering thus an intercourse with settlements which may be formed on the Columbia, more easy than between those on the heads of the Ohio and the Atlantic states. Had the party selected this route, one of the principal objects of the expedition would have been satisfactorily accomplished.

We are told in the Preface, *to our great regret*, that those parts of the work which relate to the various objects of natural history, observed or collected during the journey, are in the hands of Dr. Barton. We say *to our great regret*, because we are so much accustomed to receive from the learned Professor the most flattering promises of speedy publications, which, alas! are never accomplished.* What we find on these matters in the volumes before us, proves sufficiently that the authors have spared no pains to collect materials, though we might have wished, that men particularly skilled in the various branches of

* The works promised at various times by Dr. Barton would almost fill by themselves the shelves of a library. To quiet our anxiety, however, concerning this deluge of publications, the celebrated Professor tells us somewhere with great naivety, [we believe at the end of his fragments on the natural history of Pennsylvania] that the promises of authors are not to be taken any more literally, than the oaths of lovers.

natural history, had been attached to the expedition.—Among the quadrupeds mentioned in the history, none is distinguished by more prominent features than the *white bear*. The description given of this animal in our review of Mr. H. M. Brackenridge's Views of Louisiana,* is fully confirmed. To the account given in that place we may add the following details:

[I. p. 200.] "Of the strength and ferocity of this animal, the Indians had given us dreadful accounts: they never attack him but in parties of six or eight persons, and even then are often defeated with the loss of one or more of the party. Having no weapons but bows and arrows, and the bad guns with which the traders supply them, they are obliged to approach very near to the bear; and as no wound except through the head or heart is mortal, they frequently fall a sacrifice if they miss. He rather attacks than avoids a man, and such is the terror which he has inspired, that the Indians who go in quest of him paint themselves and perform all the superstitious rites customary when they make war on a neighboring nation. Hitherto those we had seen did not appear desirous of encountering us, but although to a skilful rifleman the danger is very much diminished, yet the white bear is still a terrible animal. On approaching two of them, captain Lewis and a hunter who was in his company, fired both and each wounded a bear, one of them made his escape; the other turned upon captain Lewis, and pursued him seventy or eighty yards, but being badly wounded, he could not run so fast as to prevent him from reloading his piece, which he again aimed at him, and a third shot from the hunter brought him to the ground: he was a male, not quite full grown, and weighed about 300 pounds: the legs are somewhat longer than those of the black bear, and the talons and tusks much larger and longer. The testicles are also placed much further forward and suspended in separate pouches from two to four inches asunder, while those of the black bear are situated back between the thighs, and in a single pouch like those of the dog: its color is a yellowish brown, the eyes small, black and piercing, the front of the fore-legs near the feet is usually black, and the fur is finer, thicker and deeper than that of the black bear; add to which, it is a more furious animal, and very remarkable for the wounds which it will bear without dying."

This tenacity to life, however, seems not to be altogether confined to the species of the white bear. If there is no error in the names, it is equally shared by the brown bear. This will be evident from the following account:

* See the first No. of the Western Gleaner, p. 57.

[I. p. 214.] "After five in the afternoon, one of our men who had been affected with biles, and suffered to walk on shore, came running to the boats with loud cries and every symptom of terror and distress: for some time after we had taken him on board he was so much out of breath as to be unable to describe the cause of his anxiety, but he at length told us, that about a mile and a half below he had shot a brown bear, which immediately turned and was in close pursuit of him; but the bear being badly wounded could not overtake him. Captain Lewis with seven men, immediately went in search of him, and having found his track, followed him by the blood for a mile, and found him concealed in some thick brushwood, and shot him with two balls through the skull: Though somewhat smaller than that killed a few days ago, he was a monstrous animal, and a most terrible enemy: our man had shot him through the centre of the lungs, yet he had pursued him furiously for half a mile, then returned more than twice that distance, and with his talons had prepared himself a bed on the earth two feet deep and five feet long, and was perfectly alive when they found him, which was at least two hours after he received the wound. The wonderful power of life which these animals possess, render them dreadful: there is no chance of killing them by a single shot unless the ball goes through the brains, and this is very difficult on account of two large muscles which cover the side of the forehead, and the sharp projection of the centre of the frontal bone, which is also thick."

Many encounters of the men with these terrible animals are related in the work, when their lives were saved only by hair-breadth escapes. From among the number we shall only select the following instances:

[I. p. 216.] "Towards evening the men in the hindmost canoes discovered a large brown bear lying on the open grounds, about 300 paces from the river: six of the men, all good hunters, immediately went to attack him, and concealing themselves by a small eminence, came unperceived within forty paces of him: four of the hunters now fired, and each lodged a ball in his body, two of them directly through the lungs: the furious animal sprung up and ran open-mouthed upon them; as he came near, the two hunters who had reserved their fire gave him two wounds, one of which breaking his shoulder, retarded his motion for a moment; but before they could reload, he was so near that they were obliged to run to the river, and before they reached it, he had almost overtaken them; two jumped into the canoe; the other four separated, and concealing themselves in the willows, fired as fast as each could reload: they struck him several times, but instead of weakening the monster, each shot seemed only to direct him towards

the hunters, till at last he pursued two of them so closely, that they threw aside their guns and pouches, and jumped down a perpendicular bank of twenty feet, into the water; the bear sprang after them, and was within a few feet of the hindmost, when one of the hunters on shore shot him in the head and finally killed him; they dragged him to the shore, and found that eight balls had passed through him in different directions."

[I. p. 264.] "Captain Lewis soon met a herd of at least one thousand buffaloe, and being desirous of providing for supper, shot one of them; the animal immediately began to bleed, and Capt. Lewis, who had forgotten to reload his rifle, was intently watching to see him fall when he perceived a large brown bear, who was stealing on him unperceived, and was already within twenty steps. In the first moment of surprise he lifted his rifle, but remembering instantly that it was not charged, and that he had not time to reload, he felt that there was no safety but in flight. It was in the open level plain, not a bush nor a tree within three hundred yards, the bank of the river sloping and not more than three feet high, so that there was no possible mode of concealment; captain Lewis, therefore, thought of retreating in a quick walk as fast as the bear advanced towards the nearest tree; but as soon as he turned, the bear ran open mouth and at full speed upon him. Captain Lewis ran about eighty yards, but finding that the animal gained on him fast, it flashed on his mind that by getting into the water to such a depth that the bear would he obliged to attack him swimming, there was still some chance of his life; he therefore turned short plunged into the water about waist deep, and facing about, presented the point of his espontoon. The bear arrived at the water's edge within twenty feet of him, but as soon as he put himself in this postnre of defence, he seemed frightened, and wheeling about, retreated with the same precipitation as he had pursued."

It appears, that the bears on the Missouri, as well as those on the waters of the Columbia present a very great variety of colors, but that they may all be ranged into three principal species. The Indians class the deep and the pale grizzly red, the grizzly dark brown, in short, all those with the extremities of the hair of a white or frosty color, without regard to the color of the ground of the foil, under the name of *hokhost*. They assured the party, that they were all of the same species with the white bear; that they associated together, had longer nails than the others, and never climbed trees On the other hand, the black bears, those which are black, with a number of entire-

ly white hairs intermixed, or with a white breast, the uniform bays, the brown and light-reddish brown, are ranged by them under the class *yakkah*, and are said to resemble each other in being smaller, and having shorter nails than the white bear, in climbing trees and being so little vicious that they can be pursued with safety.

The white or grizzly bear belongs equally to both sides of the Rocky mountains; but the black and reddish brown bear, called by the Indians yakkah, is to be found exclusively on the west side of the Rocky mountains, and forms a distinct species from the black bear of the Atlantic and Pacific oceans, which two last seem to form a third species. The yakkah differs from the latter in having much finer, thicker and longer hair, with a greater proportion of fur mixed with it, and also in having a variety of colors, while the common black bear has no intermixture or change of colors, but is of a uniform black.

The number of *buffaloes* found in the plains of the Missouri is almost incredible. Some herds of them have been estimated at fifty thousand heads. The *antelope*, an elegant species of deer, is particularly remarkable for its fleetness and the extreme delicacy of its smell:

[I. p. 75] "Of all the animals we had seen, the antelope seems to possess the most wonderful fleetness; shy and timorous, they generally repose only on the ridges, which command a view of all the approaches of an enemy, the acuteness of their sight distinguishes the most distant danger, the delicate sensibility of their smell defeats the precautions of concealment, and when alarmed, their rapid career seems more like the flight of birds than the movementt of an earthly being. After many unsuccessful attempts, captain Lewis, at last, by winding round the ridges, approached a party of seven, which were on an eminence, towards which the wind was unfortunately blowing. The only male of the party frequently encircled the summit of the hill, as if to announce any danger to the females, who formed a group at the top. Although they did not see captain Lewis, the smell alarmed them, and they fled when he was at the distance of two hundred yards; he immediately ran to the spot where they had been, a ravine concealed them from him, but the next moment they appeared on a second ridge at the distance of three miles. He doubted whether it could be the same, but their number, and the extreme rapidity with which they continued their course, convinced him, that they must have gone with a speed equal to that of the most distinguished race-horse.

*Wolves* are very abundant, and are of two species, which are described in the following manner:

[I. p. 207.] "The first species of wolves, is the small wolf or burrowing dog of the prairies, which are found in almost all the open places. It is of an intermediate size between the fox and the dog, very delicately formed, fleet and active. The ears are large, erect and pointed; the head long and pointed, like that of the fox; the tail long and bushy; the hair and fur of a pale reddish brown color, though much coarser than that of the fox; the eye of a deep sea-green color, small and piercing; the talons rather longer than those of the wolf of the Atlantic states, which animal, as far as we can perceive, is not to be found on this side of the river Platte. The wolves usually associate in bands of ten or twelve, and are rarely if ever seen alone, not being able singly to attack a deer or antelope. They live and rear their young in burrows, which they fix near some pass or spot much frequented by game, and sally out in a body against any animal which they think they can overpower, but on the slightest alarm retreat to their burrows making a noise exactly like that of a small dog.

"The second species is lower, shorter in the legs, and thicker than the Atlantic wolf, their color, which is not affected by the seasons, is of every variety of shade, from a grey or blackish brown to a cream colored white. They do not burrow, nor do they bark, but howl, and they frequent the woods and plains, and skulk along the skirts of the buffaloe herds, in order to attack the weary or wounded."

The *Argalea* or big-horn, [grosse corne] so called from the large size of the horns, some of them being two feet in length, and four or five inches in diameter, are very abundant on the Missouri; they are extremely shy, and climb without difficulty to the top of the highest mountain, and sport upon the giddy brink of precipices. In size they exceed the deer, and have a fine soft hair. The party did not meet with any of these animals below the place where White-earth river empties into the Missouri, nor does it seem to exist on the western side of the Rocky Mountains. They often feasted agreeably on its flesh, which is extremely tender, delicate and well flavored, and resembles in color and flavor our mutton, though it is not so strong.

*Elk* or *deer* are found in great numbers on the Missouri, and more sparingly on the waters of the Columbia. The *burrowing squirrel* has already been mentioned in a former part of

our publication. A great number of other quadrupeds, birds, &c. are likewise peculiar to those regions, but most of them are not distinguished enough by interesting features to engage the curiosity of the general reader. To the wild beasts of the forest we may add the *horse* and the *dog*. The former is confined principally to the nations inhabiting the great plains of the Columbia; they are extremely numerous, and the race is very beautiful.

That a tract of country so extensive and so various in point of soil and of climate, is not less rich in vegetable productions, may easily be supposed. Many of them are described with scientific precision, and will furnish the botanist with an abundant harvest of information. The limits of our pages, however, prevent us from indulging in any extracts from this very interesting part of the work. Plants, whose roots contain a large quantity of fecula, and which, on that account are used as food by the natives, who can procure only a scanty supply of game, are particularly abundant on the western side of the Rocky mountains, and on the waters of the Columbia. Among them, the *pasheco quamash*, the *wappatoo*, or the common sagittifolia [arrowhead] a kind of thistle, called *shalatanque*, a peculiar species of *rush*, and various species of *fern*, are the most remarkable.

The mineral productions of those countries have not less shared the attention of the travellers, but in this branch of knowledge they appear to have been more particularly deficient. Their accounts in this respect are vague and unsatisfactory. Common salt is extremely abundant on the upper Missouri, and many creeks and smaller rivulets which fall into this river, are so much tainted with this substance, that they became absolutely unfit for drinking. On White-earth river the salts are so abundant that in many places the ground appears perfectly white. Near the Yellowstone river the banks and sandbars are covered with a white incrustation, like frost. In most situations where salt is found, mineral coal makes likewise its appearance; it seems frequently to have undergone a partial combustion and is accompanied in that case with pumice-stone and other productions commonly considered as volcanic. Sulphur is also mentioned in the same situations. Alum and copperas

abound in the mineral bluffs near Prickly-pear river, where we are told that the travellers found likewise cobalt, which had the appearance of soft isinglass, probably the laminated grey cobalt alloyed with arsenic. The use of the waters which flow through the district where this ore is found occasioned to the party severe disorders of the stomach and the bowels. Mineral springs are frequent throughout the mountainous country.

Among the natural phenomena observed during the expedition, there is one which may justly exercise the sagacity of the philosopher. We relate it in the words of the original:

[I. p. 191.] "Since our arrival at the falls of the Missouri, we have repeatedly heard a strange noise coming from the mountains, in a direction a little to the north of west. It is heard at different periods of the day and night, sometimes when the air is perfectly still and without a cloud, and consists of one stroke only, or of five or six discharges in quick succession. It is loud and resembles precisely the sound of a six pound piece of ordnance at the distance of three miles. The Minnetarees frequently mentioned this noise like thunder, which they said the mountains made; but we had paid no attention to it, believing it to have been some superstition or perhaps a falsehood. The watermen also of the party say, that the Pawnees and Riccaras give the same account of a noise heard in the Black mountains to the westward of them. The solution of the mystery given by the philosophy of the watermen is, that it is occasioned by the bursting of the rich mines of silver confined within the bosom of the mountain."

The climate of the country situated to the west of the Rocky mountains, differs essentially from that on the east side, in being milder and much more rainy. The lands on the Columbia are rich and highly susceptible of cultivation, but the deficiency of wood will be a great obstacle to extensive settlements. The quamash flats, situated on the west side of the last range of the Rocky mountains, near the confluence of the Chopunnish with the Kooskooskee, are described as the spot the most favorable to foster a numerous population. The navigation of the Columbia and of its tributary streams is frequently interrupted by falls and rapids, which will for ever render them unfit for an extensive inland navigation.

Those who in books of travels look more particularly for entertainment, will be gratified with the accounts given of the

native Indians. These barbarous tribes seem to be grouped around us, like children of various ages around a man arrived at full maturity, to remind him of the helpless weakness of his first years, and the slow and gradual progress through which he had ripened into manhood. They display human nature in a light, which, indeed, is not always advantageous, but which still will lead the philosophical and benevolent observer to the consoling conclusion, that man is naturally good, and that the errors and vices of our species can mostly be accounted for by education, habits and situations in life. One of the most distinguishing traits in the character of these nations is *superstition*, the darling child of ignorance. The following tradition of the Osages would not be altogether unworthy of the Greek mythology:

[I. p. 9.] "According to universal belief, the founder of the nation was a snail, passing a quiet existence along the banks of the Osage, till a high flood swept him down to the Missouri, and left him exposed on the shore. The heat of the sun at length ripened him into a man, but with the change of his nature he had not forgotten his native seats on the Osage, towards which he immediately bent his way. He was, however, soon overtaken by hunger and fatigue, when happily the Great Spirit appeared, and giving him a bow and arrow, shewed him how to kill and cook deer, and cover himself with the skin. He then proceeded to his original residence, but as he approached the river, he was met by a beaver, who inquired haughtily who he was, and by what authority he came to disturb his possession. The Osage answered, that the river was his own, for he had once lived on its borders. As they stood disputing, the daughter of the beaver came, and having by her entreaties reconciled her father to this young stranger, it was proposed that the Osage should marry the young beaver, and share with her family the enjoyment of the river. The Osage readily consented, and from this happy union there soon came the village and the nation of the Wabasha or Osages, who have ever since preserved a pious reverence for their ancestors, abstaining from the chace of the beaver, because, in killing that animal, they killed a brother of the Osage. Of late years, however, since the trade with the whites has rendered beaver-skins more valuable, the sanctity of these maternal relatives has visibly been reduced, and the poor animals have nearly lost all the privileges of kindred."

A mound of the shape of a parallelogram, formed with extreme symmetry, on the banks of the White-stone river, is a subject of great superstition among the neighboring tribes.

[I. p. 92.] "This mound is called the mountain of Little People or Little Spirits, and the Indians believe that it is the abode of little devils, in the human form, of about eighteen inches high, and with remarkable large heads; they are armed with sharp arrows, with which they are very skilful, and are always on the watch to kill those who should have the hardihood to approach their residence. The tradition is, that many have suffered from these little evil spirits, and among others, three Maha Indians fell a sacrifice to them a few years since. This has inspired all the neighboring nations, Sioux, Mahas, and Ottoes, with such terror that no consideration could tempt them to visit the hill. We saw none of those wicked little spirits; nor any place for them, except some small holes, scattered over the top; we were happy enough to escape their vengeance, though we remained some time on the mound to enjoy the delightful prospect of the plain which spreads itself out till the eye hits upon the N. W. hills at a great distance, and the N. E. still further off, enlivened by large herds of buffaloe feeding at a distance."

A tradition of a more poetical and more amiable kind exists among the Ricaras. They worship three stones placed one near the other, two of which resemble human figures, and the third a dog. The fable concerning them is the following:

[I. p. 107.] "A young man was deeply enamored with a girl whose parents refused their consent to the marriage. The youth went out into the fields to mourn his misfortunes; a sympathy of feelings led the lady to the same spot, and the faithful dog would not cease to follow his master. After wandering together, and having nothing but grapes to subsist on, they were at last converted into stone, which, beginning at the feet, gradually invaded the nobler parts, leaving nothing unchanged but a bunch of grapes which the female holds in her hand to this day. Whenever the Ricaras pass these sacred stones, they stop to make some offering of dress to propitiate these deities. Such is the account of the Ricaras chief which we had no mode of examining, except that we found one part of the story very agreeably confirmed; for on the river near where the event is said to have occurred, we found a greater abundance of grapes than we had yet seen."

We meet with numerous instances which go to prove how much the character of the natives is affected by their mode of living. All the nations that live on the waters of the Missouri,

and that subsist principally on the produce of the chace, are of a more fierce and more warlike disposition than those who inhabit the plains of the Columbia, and whose principal food are fish and roots.—The account given of the latter introduces us to the acquaintance of Indian tribes, who, in their external appearance, as well as in their characters, manners and habits of life, are essentially different from those tribes on our frontiers with whom we are more particularly acquainted.

[II. p. 130.] "The Killamucks, Clatsops, Chinnooks and Cathlamahs, the four nations on the shores of the Pacific Ocean, with whom we have had most intercourse, preserve a general resemblance in person, dress, and manners. They are commonly of a diminutive stature, badly shaped, and their appearance by no means prepossessing. They have broad, thick, flat feet, thick ancles, and crooked legs; the last of which deformities is to be ascribed, in part, to the universal practice of squatting, or sitting on the calves of their legs and heels, and also to the tight bandages of beads and strings wore round the ancles, by the women, which prevent the circulation of the blood, and render the legs, of the women particularly, ill-shaped and swollen. The complexion is the usual copper colored brown of the North American tribes, though the complexion is rather lighter than that of the Indians on the Missouri, and the frontier of the United States; the mouth is wide, and the lips thick; the nose of a moderate size, fleshy, wide at the extremities, with large nostrils, and generally low between the eyes, though there are some instances of high aquiline noses; the eyes are generally black, though we occasionally see them of a dark yellowish brown, with a black pupil. But the most distinguished part of their physiognomy, is the peculiar flatness and width of their forehead, a peculiarity which they owe to one of those customs by which nature is sacrificed to fantastic ideas of beauty.....Soon after the birth of her child, the mother, anxious to procure for her infant the recommendation of a broad forehead, places it in the compressing machine, where it is kept for ten or twelve months; though the females remain longer than the boys. The operation is so gradual, that it is not attended with pain; but the impression is deep and permanent. The heads of the children when they are released from the bandage, are not more than two inches thick, about the upper edge of the forehead, and still thinner above; nor with all its efforts can nature ever restore its shape; the heads of grown persons being often in a straight line from the nose, to the top of the forehead."

"The hair of both sexes is parted at the top of the head, and thence falls loosely behind the ears, over the back and shoulders. They use combs, of which they are very fond, and indeed, contrive without the aid of them, to keep their hair in very good order. The dress of the men consists in a small robe, reaching to the middle of the thigh, tied by a string across the breast, with its corners hanging loosely over their arms. These robes are in general composed of the skins of a small animal, which we have supposed to be the brown mungo. They have besides, those of the tiger, cat, deer, panther, bear, and elk, which last is principally used in war parties. Sometimes they have a blanket wove with the fingers from the wool of their native sheep; occasionally a mat is thrown over them to keep off rain: but except this robe, they have no other article of clothing during winter or summer, so that every part of the body but the back and shoulders are exposed to view. They are very fond of the dress of the whites, and whenever they can procure any clothes, wear them in our manner, the only article, indeed, which we have not seen among them is the shoe."

"The robe of the women is like that worn by the men, except that it does not reach below the waist. Those most esteemed are made of sea-otter skins, which being twisted, are interwoven with silk grass or the bark of the white cedar, in such a manner that the fur appears equally on both sides, so as to form a soft and warm covering. The garment which covers the body from the waist as low as the knee before and the thigh behind, is the tissue already described, and is made either of the bruised bark of white cedar, the twisted cords of silk-grass, or of flags and rushes. Neither leggings or moccasins are ever used, the mildness of the climate not requiring them as a security from the weather, and their being so much in the water rendering them an incumbrance. The only covering for the head is a hat made of bear-grass, and the bark of cedar, interwoven in a conic form, with a knob of the same shape at the top. It has no brim, but is held in the hand by a string passing under the chin and tied to a small rim inside of the hat. The colors are generally black and white only, these are made into squares, triangles, and sometimes rude figures of canoes and seamen harpooning whales. This is all the usual dress of the females: but if the weather be unusually severe, they add a vest formed of skins like the robes, tied behind, without any shoulder-straps to keep it up. As this vest covers the body from the armpits to the waist, it conceals the breasts, but in all other occasions they are suffered to remain loose and exposed, and present, in old women especially, a most disgusting appearance."

"Sometimes, though not often, they mark their skins by puncturing and introducing some colored matter..... The favorite decoration, how-

ever, of both sexes, are the common coarse blue and white beads, which are folded very tightly round their wrists and ancles, to the width of three or four inches, and worn in large loose rolls, round the neck, or in the shape of earrings, or hanging from the nose, which last mode is peculiar to the men. There is also a species of wampum very much in use, which seems to be wove in its natural form without any preparation. .... The men also use collars made of bears' claws, the women and children those of elks' tusks, and both sexes are adorned with bracelets of copper, iron, or brass, in various forms."

....."Yet all these decorations are unavailing to conceal the deformities of nature and the extravagance of fashion; nor have we seen any more disgusting object than a Chinnook or Clatsop beauty in full attire. Their broad, flat foreheads, their falling breasts, their ill-shaped limbs, the awkwardness of their positions, and the filth which intrudes through their finery; all these render a Chinnook or Clatsop beauty in full attire, one of the most disgusting objects in nature. Fortunately, this circumstance, conspired with the low diet and laborious exercise of our men, to protect them from the persevering gallantry of the fair sex, whose kindness always exceeded the ordinary courtesies of hospitality. Among these people, as indeed among all Indians, the prostitution of unmarried women is so far from being considered criminal or improper, that the females themselves solicit the favors of the other sex, with the entire approbation of their friends and connexions. The person is in fact often the only property of a young female, and is therefore the medium of trade, the return for presents, and the reward for services.—To decline an offer of this sort is indeed to disparage the charms of the lady, and therefore gives such offence, that although we had occasionally to treat the Indians with rigour, nothing seemed to irritate both sexes more than our refusal to accept the favors of the females"....

"We find these nations very inquisitive and loquacious, with understandings by no means deficient in acuteness, and with very retentive memories; and though fond of feasts, and generally cheerful, they are never gay. Every thing they see excites their attention and enquiry, but having been accustomed to see the whites, nothing appeared to give them more astonishment than the air-gun. To all our inquiries they answer with great intelligence, and the conversation never slackens, since there is a constant discussion of the events, and trade, and politics, in the little but active circle of Killamucks, Clatsops, Cathlamahs, Washkiacums and Chinnooks. Among themselves, the conversation generally turns on the subjects of trade, or smoking, or eating, or commerce with females, before whom this last is spoken

of with a familiarity, which would be in the highest degree indecent, if custom had not rendered it inoffensive."

..... "Among the Clatsops and Chinnooks, who live upon fish and roots, which the women are equally expert with the men in procuring, the former, on account of their usefulness, have a rank and influence very rarely found among Indians. The females are permitted to speak freely before the men, to whom indeed they sometimes address themselves in a tone of authority. On many subjects their judgments and opinions are respected, and in matters of trade, their advice is generally asked and pursued. The labors of the family too, are shared almost equally. The men collect wood and make fires, assist in cleaning the fish, make the houses, canoes, and wooden utensils; and whenever strangers are to be entertained, or a great feast prepared, the meats are cooked and served up by the men. The peculiar province of the female is to collect roots, and to manufacture the various articles which are formed of rushes, flags, cedar-bark and bear-grass; but the management of the canoes, and many of the occupations, which elsewhere devolves wholly on the female, are here common to both sexes."

..... "Old age is respected and fostered with care. The dispositions of these people in general seem mild and inoffensive. They are addicted to begging and pilfering small articles, when it can be done without danger of detection, but do not rob wantonly, nor to any large amount.—Their large houses usually contain several families, consisting of the parents, their sons and daughters in law, and grand children, among whom the provisions are common, and whose harmony is scarcely ever interrupted by disputes. Although polygamy is permitted by their customs, very few have more than a single wife, and she is brought immediately after the marriage into the husband's family, where she resides until increasing numbers oblige them to seek another house.—In this state the old man is not considered as the head of the family, since the active duties, as well as the responsibility, fall on some of the younger members. As these families gradually expand into bands or tribes, or nations, the paternal authority is represented by the chief of each association. This chieftain, however, is not hereditary; his ability to render service to his neighbors, and the popularity which follows it, is at once the foundation and the measure of his authority, the exercise of which does not extend beyond a reprimand for some improper action."

"The harmony of their private life is indeed secured by their ignorance of spirituous liquors, which seem not to be used by any Indians west of the Rocky mountains, the universal beverage being pure water. They, however, sometimes almost intoxicate themselves by smoking

tobacco of which they are excessively fond, and the pleasures of which they prolong as much as possible, by retaining vast quantities at a time, till after circulating through the lungs and stomach, it issues in volumes from the mouth and nostrils. But the natural vice of all these people, is an attachment for games of hazard which they pursue with a strange and ruinous avidity." ....

"In traffic they are keen, acute and intelligent, and they employ in all their bargains a dexterity and finesse, which, if it be not learnt from their foreign visitors, may shew how nearly the cunning of savages is allied to the little arts of more civilized trade. They begin by asking double and treble the value of their merchandise, and lower the demand in proportion to the ardor or experience in trade of the purchaser; and if he expresses any anxiety, the smallest article, perhaps a handful of roots, will furnish a whole morning's negociation. Being naturally suspicious, they of course conceive, that you are pursuing the same system. They, therefore, invariably refuse the first offer, however high, fearful that they or we have mistaken the value of the merchandise, and therefore cautiously wait to draw us into larger offers. In this way, after rejecting the most extravagant prices, which we have offered merely for experiment, they have afterwards importuned us for a tenth part of what they had before refused. In this respect, they differ from almost all Indians, who will generally exchange in a thoughtless moment the most valuable article they possess, for any bawble which happens to please their fancy."

..... "The articles of this trade consist chiefly in dried fish, skins, mats, silk grass, rushes, quamash, chapelelle bread, horses and beads. From the foreign nations that frequent the shore they obtain guns, powder, ball and shot, copper and brass kettles, blankets, cloth, sheet, copper and brass, knives, tobacco, fish-hooks, and sailors' equipments. But the object of foreign trade, which is the most desired, are the common cheap blue or white beads, of about fifty or seventy to the pennyweight, which are strung on strands a fathom in length, and sold by the yard, or the length of both arms; of these, the blue beads, which are called tia commascheck, or chief beads, hold the first rank in their ideas of relative value: the most inferior kind are esteemed beyond the finest wampum, and are temptations which can always seduce them to part with their most valuable effects. Indeed, if the example of civilized life did not completely vindicate their choice, we might wonder at their infatuated attachment to a bawble in itself so worthless. Yet these beads are, perhaps, quite as reasonable objects of research as the precious metals, since they are at once beautiful ornaments for the person, and the great circulating medium of trade with all the nations on the Columbia."

Upon the whole, we must confess that if these barbarians are not in possession of the advantages of civilized life, their vices and their virtues may stand a fair chance of supporting a comparison with ours. The picture given of the Chopunnish who reside on the waters of the Kooskooskee and Lewis's river, is still more engaging and more proper to raise in our esteem our Indian brethren:

[II. p. 292.] "The Chopunnish are in general stout, well formed and active; they have high, and many of them aquiline noses, and the general appearance of the face is cheerful and agreeable, though without any indication of gayety and mirth. Like most of the Indians they extract their beards; but the women only pluck the hair from the rest of the body. That of the men is very often suffered to grow, nor does there appear to be any natural deficiency in that respect, for we observe several men, who, if they had adopted the practice of shaving, would have been as well supplied as ourselves. The dress of both sexes consists of a long shirt reaching to the thigh, leggings as high as the waist, moccasins and robes, all of which are formed of skins."

"Their ornaments are beads, shells, and pieces of brass attached to different parts of the dress, or tied round the arms, neck, wrists and over the shoulders: to these are added pearls and beads, suspended from the ears, and a single shell of wampum through the nose.—The head dress of the men is a bandeau of fur or otter skin, either with or without the fur, and sometimes an ornament is tied to a plate of hair, falling from the crown of the head: that of the women is a cap without rim, formed of bear-grass and cedar-bark; while the hair itself, of both sexes, falls in two rows down the front of the body. Collars of bears' claws are very common. But the personal ornament most esteemed is a sort of breast plate, formed of a strip of otter-skin, six inches wide, cut out of the whole length of the back of the animal, including the head; this being dressed with the hair on, a hole is made at the upper end, through which the head of the wearer is placed, and the skin hangs in front with the tail reaching below the knee, and ornamented with pieces of pearl, red cloth and wampum: or, in short, any other fanciful decoration. Tippets also are occasionally worn. That of a chief was formed of human scalps, and adorned with the thumbs and fingers of several men slain by him in battle."

"The Chopunnish are among the most amiable men we have seen. Their character is placid and gentle, rarely moved into passion, yet not often enlivened by gayety. Their amusements consist in running races, shooting with arrows at a target, and they partake of the great and prevailing vice of gambling. They are, however, by no means so

much attached to bawbles as the generality of Indians, but are anxious to obtain articles of utility, such as knives, tomahawks, kettles, blankets, and awls for moccasins. They have also suffered so much from the superiority of their enemies, that they are equally desirous of procuring arms and ammunition, which they are gradually acquiring."

We regret that the limits of our pages do not permit us to transcribe the very interesting account which is given in the history of the expedition, of the Snoshonees, a small tribe of the nation called Snake Indians, a vague denomination, which embraces at once the inhabitants of the southern parts of the Rocky mountains and of the plains on each side. They are a wretched migrating tribe, who venture but seldom out of the mountains into the plains of the Missouri, where they are afraid to meet their enemies, the Pawkees. During summer they reside on the waters of the Columbia, where they subsist chiefly on fish and roots. Nothing can be imagined more miserable than their condition, when the salmon are fast retiring, when roots are becoming scarce, and when, prior to their junction with other friendly tribes, which takes place commonly late in the season, they have not yet acquired strength to hazard an encounter with their enemies. So insensible are they, however, to these calamities, that the Shoshonees are not only cheerful, but even gay. Their character, which is more interesting, perhaps, than that of any other Indians in that tract of country, has in it much of the *dignity of misfortune*. They are in general represented as possessing a lively, noble, generous and manly character, and the party had every reason to be pleased with their kind and obliging behavior.

The respect paid to the dead by savage tribes, is one of the peculiarities of our nature, which shews, that the *instinctive* belief of a continuation of existence after this life, is deeply engraved on the human heart. The customs followed in this respect by the Indians living in the vicinity of the United States, are sufficiently known; those adopted by the various nations on the west side of the Rocky mountains seem to depend chiefly on their different modes of life and situation:

[II. p. 120.] "The Chinnooks, Clatsops, and most of the adjoining nations dispose of the dead in canoes. For this purpose a scaffold is

erected, by fixing perpendicularly in the ground four long pieces of split timber. These are placed two by two, just wide enough apart to admit the canoe, and sufficiently long to support its extremities. The boards are connected by a bar of wood run through them the height of six feet, on which is placed a small canoe containing the body of the deceased, carefully wrapped in a robe of dressed skins, with a paddle and some articles belonging to the deceased, by his side. Over this canoe is placed one of a larger size, secured with its gunwale resting on the cross-bars, so as to cover the body completely. One or more large mats of rushes or flags are then rolled round the canoes, and the whole secured by cords usually made of the bark of the white cedar. On these cross-bars are hung different articles of clothing, or culinary utensils. The method practised by the Killamucks differs somewhat from this: the body being deposited in an oblong box of plank, which, with the paddle and other articles, is placed in a canoe, resting on the ground."

[II. p. 223.] "The Choppunnish bury their dead in sepulchres, formed of boards, constructed like the roof of a house. The body is rolled in skins, and laid one over another, separated by a board only, both above and below. We have sometimes seen their dead buried in wooden boxes, and rolled in skins. They sacrifice their horses, canoes, and every other species of property to their dead; the bones of many horses are seen lying round their sepulchres."

The manner in which the term *medicine* is taken by the Indian tribes, denotes in a striking manner their ignorance and their incapacity of connecting causes with effects. It signifies any inexplicable, supernatural power, and is in many instances equivalent with the idea that we form of a genius. Thus, we hear in the history of the expedition, of medicine-stones which are worshipped as a kind of idols, and consulted as oracles. The air-gun of the American travellers was in their eyes a great medicine. Among the Chilukittegaws, a medicine-bag about two feet in length, containing roots, pounded dirt, &c. and sometimes the fore-fingers of the enemies slain in battle, is suspended in the middle of the lodge, and it is supposed to be a species of sacrilege to be touched by any but the owner. It is an object of religious fear, and it is from its sanctity, the safest place to deposit their medals and their more valuable articles. In another place we read the description of a medicine dance, as prac-

tised among the Mandans, which is curious enough to be here transcribed:

[I. p. 151.] "The medicine dance, is an entertainment given by any person desirous of doing honor to his medicine or genius. He announces, that on such a day he will sacrifice his horses, or other property, and invites the young females of the village, to assist in rendering homage to his medicine; all the inhabitants may join in the solemnity, which is performed in the open plain, and by day-light, but the dance is reserved for the virgins, or at least the unmarried females, who disdain the incumbrance or ornament of dress. The feast is opened by devoting the goods of the master of the feast, to his medicine, which is represented by the head of the animal itself, or by a medicine bag, if the deity be an invisible being. The young women then begin to dance, in the interval of which, each will prostrate herself before the assembly, to challenge or reward the boldness of the youth, who are often tempted by feeling or the hopes of distinction to achieve the adventure."

That these ideas, connected with the term of medicine, are the necessary result of the custom of treating diseases in many cases by charms and amulets, is evident; though they are by no means ignorant of the virtues of many plants, and of the salutary effects of warm baths of which they make a very extensive use. The catalogue of their diseases, though by far more limited than among civilized nations, is still long enough. Sore eyes seem to prevail on both sides of the Rocky Mountains, and to be owing partly to the vivid reverberation of the light from the snow, partly to the vast quantities of fine and light sand, which are driven from the sandbars, and whose particles are floating for miles in the air like a column of thick smoke. The ravages which the small pox has committed among several of the tribes, are almost incredible. The early decay of the teeth, is peculiar to the inhabitants of the Columbia. Scrofula and rheumatism, are frequent on the west side of the Rocky Mountains; instances of the venereal disease are to be found among the inhabitants of the coast. Old people are rarely to be met with in all these tribes; among the Mandans, however, we hear of the death of a man who had seen one hundred and twenty years. Of the wonderful facility with which the Indian women bring forth their children, we shall quote the following instance:

[I. p. 316.] "One of the women who had been leading two of our pack horses, halted at a rivulet, about a mile behind, and sent on the horses by a female friend: on inquiring after the cause of her detention, we were told, with great appearance of unconcern, that she had just stopped to lie in, but would soon overtake us. In fact we were astonished, to see her in about an hour's time, come on with her new born infant, and pass us, on her way to the camp, apparently in perfect health."

We have endeavored to select in the preceding pages, such passages as may give our readers some useful and agreeable information, and furnish them with an adequate idea of the manner in which the publication is conducted. It will have been perceived, that the style is clear, simple and unaffected. Digressions foreign to the subject are carefully discarded; nor is the work in any way tainted with the animosities of party-spirit. A manly, liberal and independent spirit pervades the whole.—We cannot, however, omit to mention a piece of flattery which Napoleon himself would not have disdained in the days of his greatest glory. The three forks, which by their confluence, form the Missouri, have been called by the leaders of the expedition, Jefferson, Madison and Gallatin rivers; thus far they have only followed the universal custom of discoverers to perpetuate the names of their friends and patrons. But it is certainly a refinement of this practice to see three rivers which empty into the Jefferson, designated by the names of Wisdom, Philanthropy and Philosophy rivers. The first flows with an abundant stream, and its waters roll with anxious impetuosity into the Jefferson; but we are rather astonished to see Philosophy river under the form of a scanty and insignificant rivulet, and we are dubious to decide whether this relative distribution of compliments will altogether gratify the wishes or the pretensions of the illustrious personage to whom they are addressed.

To the journal of the expedition is annexed an appendix, containing observations and reflections on the present and future state of Upper Louisiana, in relation to the government of the Indian nations inhabiting that country, and the trade and intercourse to be established with them, by captain Lewis. We are inclined to suppose that the larger portion of the history of the expedition is owing to the same pen, and certainly, it would in

that case form a monument, by no means despicable, of the talents and exertions of this unhappy man. His career was short, arduous and unrewarded. He shared with so many others who might deserve a better fate, the misfortune to see himself neglected and injured even by those to whose service he had devoted himself. He had supported with manly courage all the toils, the fatigues and the privations of a difficult enterprise, but the idea of seeing himself lost in the esteem of his countrymen, and his integrity suspected, his noble mind could not brook, and he fell a victim to the exquisite delicacy of his feelings.—Peace be with his ashes!

## ON EARTHQUAKES.*

THERE are few natural phenomena which have more universally exercised the curiosity of the vulgar, and the sagacity of the philosopher, than earthquakes. These tremendous convulsions of nature, which threaten to overwhelm a world, as it were, in the space of a moment, which no human wisdom can foresee, nor any human power arrest, have been at all times calculated to rouse into activity all the feelings and all the faculties of the mind. It is possible, that the hidden cause of these phenomena may for ever elude our researches; but the attempt, at least, at any thing like a plausible explanation, will not appear altogether nugatory, if we reflect, of what importance it would be to mankind to ascertain which phenomena can be considered as precursors of earthquakes, which are the places and situations most exposed to them, and which are the necessary laws of their action. If so much only could be established on the solid foundation of facts, we might perhaps not despair of being finally presented with proper means to prevent or at least to lessen these dreadful calamities.

* This paper on earthquakes, was written in the month of February, 1812, and read at Pittsburgh, in a public course of lectures on chemistry. This fact, it is hoped, will sufficiently screen the writer from the reproach of having borrowed or copied the sentiments of others, who since that period have published opinions of a similar nature.

The first opinion, which presented itself to men, as soon as they were led to investigate into the cause of earthquakes, was to ascribe them to a subterraneous explosion, an opinion which maintained its ground for a long time. By a more mature consideration of the subject, however, it becomes obvious, that the effect of an explosion of this nature would be a gradual lifting of the earth, after which it would fall again and no doubt destroy or change the course of the springs and considerably alter the face of the country; whilst on the contrary the shocks of an earthquake are nearly instantaneous at the greatest distances and seldom do any other mischief than overthrowing buildings. It was observed, likewise, that earthquakes were commonly attended with electrical phenomena, such as electrical corruscations, detonations in the atmosphere and other similar appearances. Hence, it was thought extremely probable, that earthquakes owed their origin to electricity. According to this hypothesis an earthquake was considered as the necessary consequence of an electrical discharge between a cloud and the earth in a highly electrified state, or even between two separate portions of the earth. But this explanation again presented many difficulties. A mere electrical discharge would probably operate in an instantaneous manner and after one or some few explosions the equilibrium would be likely to be restored. Earthquakes, on the contrary, as we have experienced it lately in this country, are often of a considerable duration, and their primary source seems to depend altogether on a continued action, which is spent only after a certain lapse of time. Nor does this hypothesis account in any manner for the supposed accumulation or diminution of the electric fluid in the bowels of the earth.—And how is it possible to reconcile with this supposition the well established fact, that peculiar countries and districts are more particularly liable to earthquakes than others, that places near the sea, or any other water are more especially affected by them, and that finally they commonly either precede, accompany or follow the most dreadful eruptions of volcanoes.

About the beginning of the last century, Lewis Lemery, a French physician of considerable merit, offered the first to the philosophical world an explanation of volcanic eruptions on chemical

principles. He had observed that when an equal quantity of iron-filings and sulphur was mixed together and formed into a paste with water, the mixture frequently did take fire, even though it were buried under ground. Hence he suggested, that volcanoes might possibly owe their origin to a similar cause, as the mixture of sulphur and iron exists abundantly in nature and particularly in volcanic districts. Modern chemistry has placed this supposition almost beyond any doubt, and my readers, I hope, will grant me their pardon if I enter a little more fully upon this matter, as being intimately connected with the theory of earthquakes.

Sulphur is one of the most common mineralizers of metals in the ores. It is found frequently combined with iron, copper, arsenic, zinc, bismuth, lead, &c. but the most abundant of these combinations, which in many places, forms entire beds, and which is also frequently found dispersed, sometimes in clay, sometimes in bitumen, and sometimes in wood decomposed and in the state of jet, is that of sulphur and iron; under the name of *martial pyrites, marcassites, &c.* These pyrites are found under very various forms. The most perfect form, however, of the mineral, seems to be a cube, under which it is found frequently in many places of the United States, particularly in the neighborhood of Lancaster. In many other places it is found under the form of round bodies or nodules, the surface of which is rugged, and full with small trihedral pyramids of the same form, which extend and terminate at a point at one common centre. In other parts again, as in the vicinity of Pittsburgh, and along the waters of the Monongahela and Allegheny rivers, they are amorphous or shapeless. They possess more or less metallic lustre, from a dull yellow to the appearance of the most brilliant gold. Their specific gravity is from 4 to 4–5. They all strike fire with steel, and easily melt when heated. The proportion of the sulphur varies considerably, from 37 parts in 100, to 54.—It sometimes happens that the sulphur disengages itself from this sulphuret, which then loses its metallic brilliancy, and assumes a blackish color. In this state it is called *ore of hepatic iron.* But when the iron thus disengaged from its mineralizer, is reduced to the state of a very fine

metallic dust, the waters carry it off and deposit it in beds, which are called *hæmatites*. It is to a similar cause that we may refer the formation of those beds of ochres, so common on the surface of the globe, with only this difference, that the decomposition of the sulphuret is here complete, and that the iron is more strongly oxydated.

But a much more important change takes place, when pyrites are exposed to the contact of water. This latter substance is a compound of oxygen and hydrogen, in the proportion of 85 parts of the former and 15 of the latter, in every 100 parts of this liquid. The affinity which keeps oxygen thus connected with hydrogen, will be broken as often as any body is presented to it, for which it has a still greater affinity or relation. Sulphur is one of those substances, the oxygen, therefore, will readily combine with the sulphur, while the hydrogen is set free under the form of gas. By this new combination, the sulphur will be acidified and changed into sulphuric acid, which in its turn will readily enter into new combinations with such substances in its vicinity for which it has a strong affinity. Thus, sulphate of iron [green vitriol,] sulphate of lime, [plaster of Paris] sulphate of alumine and potash, [alum] sulphate of magnesia, [Epsom salt] &c. are commonly formed in nature. Mineral waters, sulphuric, aluminous, sulphureous, hot and cold, are very probably the result of similar compositions. And if we suppose for a moment that the decomposition of pyrites is going on on a large scale, in such situations, where this mineral is accumulated in immense masses with the free access of water, we can scarcely entertain any doubt, but that volcanoes and earthquakes derive their origin from this source. In that case we can conceive readily, the cause of the detonations created by the violent disengagement of the hydrogen gas, as well as that of fire and flames which accompany the phenomenon; the quantity of heat which is set free, by this chemical change being quite sufficient to cause the hydrogen gas to inflame and to occasion the combustion of every contiguous matter, capable of undergoing this process. Earthquakes, according to the supporters of this opinion, are taking place, whenever the included gas cannot find a convenient issue, which, however, is to happen, only after its

elasticity has acquired a sufficient strength to overcome every obstacle, to burst the superincumbent strata and to throw the solid mass of the earth into the most violent commotions.

That this view of the matter is by no means destitute of probability, cannot be denied, especially as far as it concerns volcanoes; but the theory is more deficient, when endeavoring to account for earthquakes. That the merely local effects of pyritical decomposition should be felt at immense distances, almost instantaneously, and very frequently in lateral shocks, seems by no means satisfactorily explained in this manner. Most of the meteoric appearances, which commonly attend earthquakes remain likewise unaccounted for; because, though some of them may be ascribed to the inflammation of hydrogen gas, others bear a character too manifestly electrical to admit of this explanation exclusively.

I have yet to mention an hypothesis already established by various ancient authors, but which lately has found a respectable supporter in the person of Dr. Young. According to this hypothesis, earthquakes are produced by the expansion of water into vapor. Water raised to the temperature of 212° F. in an ordinary state of the atmosphere, is converted into steam, viz. elastic fluid, the bulk of which is not much less than 1800 times the bulk of the water from which it originated; and in that state its elasticity enables it to support the pressure of the atmosphere. If its temperature be increased by about 30° more so as to amount in all to about 242° then its elastic force will be doubled; by the addition of 30° more of heat, its elasticity will be quadrupled, and so on; nor is it known how far this increase of elasticity may be extended, by increasing the temperature. Therefore, if water happens to fall upon any thing, which can instantly communicate a very high degree of heat to it, the elasticity of the vapor, which is thereby produced, may be equal to any force we may have any idea of. The only thing requisite is the ignited substance, which is to furnish a sufficient quantity of heat; and for this purpose, large quantities of melted metals are the fittest, especially those which require a very high temperature for their fusion: metallic substances being very good conductors of heat, so that when water falls upon any part of the

melted matter, the caloric rushes to that spot from every part of the mass, and instantly converts the water into steam, possessed of a prodigious elastic force. The application of these facts to the production of volcanoes and earthquakes, appears very easy to Dr. Young. The subterraneous fires, he admits, which are continually kept up in an open volcano, depend probably in general on sulphureous combinations and decompositions, like the heating of a heap of wet pyrites, or the union of sulphur and iron filings; but in other cases, he thinks, they may approach more nearly to the nature of common fires and be nothing else but burning mountains of coal. The immediate cause of an eruption, appears to him frequently owing to an admission of water from the sea, or from subterraneous reservoirs. Boiling water has been often discharged in great quantities from a volcano, and the force of steam is in his opinion, more adequate to the production of violent explosions and commotions like those of an earthquake, than any other power in nature.

I answer to this hypothesis, that the power of steam is unquestionably perfectly sufficient to the production of the most violent explosions; but an immense mass of water, passing over a surface of melted metal or any other ignited material, would most probably extinguish the fire, or at least this effect would take place after a second explosion, whereas it is well known, that the concussions of an earthquake are frequently repeated in a more or less considerable space of time; nor is it easy to conceive how the expansive force of steam could occasion those lateral and tremulous commotions which are almost simultaneously felt at the greatest distances; but more particularly in one place, than in another; finally, those circumstances which indicate a connexion between the state of the atmosphere and the approach of an earthquake, are entirely overlooked, and cannot be explained upon this hypothesis.

The failure of the various attempts hitherto made to explain the cause of earthquakes by philosophical principles, is perhaps to be attributed to the desire, of referring to one single cause, phenomena, which, though closely connected in the economy of nature, may yet be resolved into a succession of distinctly acting causes. By allotting to each of the three last men-

tioned principles, a respective share in the production of volcanoes and earthquakes, we may perhaps come near to something like a solution of the enigma. That the primary cause of volcanoes is chiefly to be derived from the decomposition of immense beds of pyrites, exposed to the action of water, there can be but little doubt. Sulphur in its primitive state, is probably always engaged in pyritical combinations and when we find it in a relative state of purity, we may suppose, that it has been formed by a kind of subterraneous distillation. Admitting this, we may readily conceive how volcanic districts are at the same time the great reservoirs of native sulphur. The heat constantly generated in those strata of pyrites which are accessible to water, by the gradual decomposition of the mineral, will volatilize the sulphur of the superincumbent strata and thus give birth to native sulphur. In places where the communication with the open air is more free and unimpeded, or where such a communication has been formed by means of a violent rupture occasioned by the elastic power of the hydrogen gas, we will see a crater vomiting sulphuretted vapors only, when the decomposition is not rapid and abundant enough to create the heat necessary to kindle the inflammable gas. When this happens, all the phenomena of an eruption will take place. And here we may readily admit part of Dr. Young's theory. Immense caverns must have been formed in the bowels of volcanic mountains through the eruptions of so many ages and the incessant labor of disintegration. These will be heated to a considerable degree in the time of an eruption, but as the degree of heat cannot be constantly uniform, a partial vacuum will frequently take place after the least diminution of temperature; water will rush in to fill it, from all the subterraneous channels, and this passing over an ignited surface, will be immediately reduced into the state of vapor; its expansive power, will overcome every obstacle, and the explosion will be similar to the roaring of thunder, or to that of a discharge of heavy artillery. That portion of water which has not been volatilized, will, at the same time, gush out from several issues under the form of boiling water. Thus far the most important phenomena attending volcanoes seem to be satisfactorily explained. But the most powerful explosion of this

kind that our imagination can conceive, will not sufficiently account for the widely spread commotions of an earthquake, nor for the meteoric appearances which in all cases have been observed to accompany the eruptions of volcanoes as well as earthquakes.

But these difficulties will disappear, if we call in to our assistance the discoveries of modern chemistry. Whether electricity be *in all cases* the result of chemical changes, as some have supposed, or not, is indifferent to our present purpose; but that electrical phenomena and chemical changes are most intimately connected, has been proven beyond contradiction by the phenomena of the Voltaic battery. Most of those substances which act upon each other chemically, are likewise such as act electrically. The electrical equilibrium, is deranged as soon as they are brought in contact one with another, under circumstances favorable to composition or decomposition, and consequently electrical phenomena take place; but the equilibrium is restored when the chemical change has been operated. What incalculable quantities of electricity must be set into action, in the laboratory of nature, when immense masses of sulphur act upon iron through the medium of water, we must readily conceive. From the primary source of its generation the electric fluid will be conducted almost instantaneously, to the most distant places; it will follow particularly in its direction metallic beds and water courses; the rattling noises which accompany earthquakes, the lateral shocks, and tremulous motions will all be easily accounted for. The highly electrified state of the earth, previous to a volcanic eruption, will occasion in the atmosphere a similar state of electrical excitement, both forming in this case the two poles of opposite electricities; hence all those meteoric appearances which have been invariably observed on such occasions. But this is not all. The electric energy called so powerfully into action will become the efficient cause of new chemical decompositions in places extremely remote from the primitive seat of this natural event, and thus we see that a new series of phenomena, partly volcanic, is remarked in all such districts which contain in abundance pyritical matter, as for instance, places in the vicinity of sulphureous

springs. By means of this hypothesis, we can likewise conceive why it happens that earthquakes are mostly preceded by the fall of copious rains after a long drougth; as both moisture and heat are necessary for chemical decomposition, and why countries situated within, or at least, near the tropics, are more liable to them than the north ern regions. If it be objected, that earthquakes frequently happen without the eruption of volcanoes, we may observe, that chemical decomposition may take place on a large scale under such circumstances, as cannot easily give birth to volcanic eruptions. Whenever the pyritical masses acted upon, exist in beds without considerable depth, when the superincumbent strata are thin and in a state of loose aggregration so as to offer little obstacle to the escape of the elastic vapors and of heat, no volcanic appearances may be observed, though the electrical effects will operate with equal intensity. In one word, there is scarcely any natural appearance connected with earthquakes, which may not on the foundation of this hypothesis, receive a more or less satisfactory explanation. I have contented myself, for the present, to sketch merely some rough outlines of a theory, but I cannot doubt, but that the industry and sagacity of others may develop in a more competent manner, the general hints, which I have presumed to offer.

The history of the earthquake under which our country has lately suffered, seems in all its details to confirm the opinion which I have advanced. But there is one fact relative to this event, which deserves, perhaps, a more particular mention.—According to my best inquiries, made in the circumference of about forty miles round the borough of Pittsburgh in all places where coal is to be found, I could not discover one single spot where the earthquake had been felt *above* the coal-stratum, while close to the same situations, in the valleys underneath, it had been felt in the most sensible manner. This, at least, seems a proof by no means unimportant in favor of the agency of electricity.

# MISCELLANIES.

## GLASS-PLATE PRINTS,

*Intended as a ground for copper-plate printed bank-notes to prevent counterfeiting.*

TO THE EDITOR OF THE WESTERN GLEANER.

SIR,

I BEG leave to address you for publication in your valuable journal, a few observations on my new mode of preventing, *in the only effective manner*, any attempt that may be made to counterfeit bank-notes.

The engraving of bank-notes or copper-plates, has been carried lately in this country to a degree of perfection, which leaves nothing to desire in point of beauty, convenience and durability. But much as I respect the talents of the gentlemen engaged in this line, I absolutely deny that their best efforts will ever be capable of preventing counterfeiting. It has not been sufficiently attended to, that the first copies of an original note are put in circulation by the banks themselves. The plates executed by the engravers contain five notes of the same value. All the five are sometimes so much like one another, that in order to distinguish them, recourse must be had to the letter which characterizes the difference of their series. The original note bears in front of the plate the letter A; the second note the letter B; the third the letter C; the fourth the letter D, and finally the fifth the letter E. Here then we have evidently four copies of the original note A.

How then should we expect that criminal hands directed by the allurements of gain would not do what is practised every day by the very orders of banking companies?

It appears, that in order to remedy this evil, it would be necessary to find out distinctive marks easily produced, without the help of the hand of the artist, equally easy to distinguish at the first glance, and presenting such difficulties to counterfeiting, as to baffle every attempt at imitating them.

The method of which I am the inventor, and which I have the honor to communicate to you, will, I trust, unite all the above mentioned conditions.

The engraving performed by my method represents a kind of marbling, of which an adequate idea can be formed only by imagining a mixture of oil and of vinegar spread at random over a polished surface.

The engravings are destined merely to form a *ground* for bank-notes engraved in the common way; they diminish in nothing the original elegance, which is the work of the graver, fill only the space occupied by the engraved letters, and leave in blank all the space of the extremities, of the central *vignette*, and of the signatures. They are printed on the note either before or after the impression is taken from the copper-plate.

Besides the primary and essential advantage of my method in preventing counterfeiting, you will allow me, sir, to mention another advantage attached to it, which renders it no less recommendable—A glass-plate, containing two notes ready to be printed, costs 120 dollars; it will give more than 20,000 excellent proofs. A copper-plate is worn out long before so many proofs have been taken from it.

The various degrees of perfection which have been given to bank-notes since about 15 years, go sufficiently to prove, that the banking companies have been impressed with an idea of the necessity, on one hand, of rendering the task of counterfeiting more difficult; on the other, of presenting to the public more varied means of comparison, in order to inspire a greater confidence in their notes. We may therefore reasonably hope, that they will avail themselves of any further improvement which may impart to the notes put in circulation by them, those so much desired qualities.

Permit me to observe, Sir, that all the guarantee which the banks could hitherto give to the public consists merely in the confidential belief, that the artists employed by them would be too honest to engrave to their own profit, an additional copy of their notes. This guarantee, howsoever respectable, is still nothing more than a moral one, which finally rests entirely on the dispositions or will of an individual. The guarantee offered by my method, is a physical one; for it rests on the impossibility of producing by the same proceedings, two plates engraved in a similar manner, and if the imitation of a glass-plate was

attempted by any other means, this imitation could only pass from the hands of the counterfeiter into the public, if no care was taken to cast a look upon it, or if the original engraving on glass had never been seen.

My glass-plate prints, offer to the eye two peculiarities which deserve to be particularly noticed, viz. the *form* of the spots produced by chance, and their *shades*. With respect to the first it is easily conceived, how difficult it is to scatter and to spread in an uniform manner a corrosive substance, over a thousand various points, and how vain would be any attempt at reproducing the same accidents a second time. As to the second, it may be geometrically demonstrated, that it is impossible to produce on copper, the same shades as on the glass; the fluoric acid employed for engraving on glass, acts upon this substance in such a manner as to leave the bottom of the engraving parallel to the surface of the glass; the nitric acid, on the contrary, leaves on the metal which it has corroded an irregular and oval cavity. The graver forms in the same metal a conical incision; the curve described by the sheet of paper under the pressure of the cylinder, at the orifice of each of these engravings, leaves evidently more ink towards the centre of the engraving on copper than of that on glass, hence it naturally follows that the traits of the copper print will be of a comparatively deeper shade towards the centre than on the extremities, and those of the glass-plate print, on the contrary, will be of a deeper shade on the extremities, than towards the centre. This essential difference renders it absolutely impossible to reproduce on the same plate at once, the *form* or the accidents and their *shades*, for by using glass the shades may be imitated but not the accidents, and if by using copper, it was possible to imitate sufficiently the form of the accidents, it would be at least impossible to obtain the same shades.

Such is the chain of obvious reasonings, founded on facts, which induces me to believe, that my method is the only adequate means to give to bank-notes that degree of perfection, which they were destitute of until this day, namely, by superadding to them such distinctive characters which are easily recog-

nized, in which the premeditated work of the hand has not any influence, and whose imitation baffles all the skill of the most experienced engraver.

I have the honor to be, Sir, &c.

J. J. BOWDIER.

*Pittsburgh, 5 May*, 1814.

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FOR THE WESTERN GLEANER.

## PODOPHYLLUM PELTATUM, MAY-APPLE OR WILD LEMON.

THIS plant grows in abundance in Pennsylvania, and is known by almost every one. The root is an excellent purgative: 10 or 12 grs. of the powdered root, combined with 4 or 6 grs. of calomel, is a very good way of using it.

It seems well suited to obstinate *intermittents* and *remittents*. The medium dose for an adult is 20 grs. It produces larger evacuations by stool, than jalap. The proper time to take up the root, is when the apple or fruit is fully ripe, and the leaves become yellow. The leaves are considerably poisonous, and the root is in some degree narcotic. When given in fevers, it not only purges, but seems also to break off the type of the fever. It is said to be *anthelmintic*. It does not gripe so much, nor is it so apt to vomit as jalap. It keeps off the evacuations longer than jalap. Dr. Barton is of opinion, that it is a better purgative than jalap. Dr. Young says "When it is used in fevers, less bark is required afterwards to cure the fever." I am of opinion, that its use would be well worth the trial of our western physicians, not only from its known good effects, but from its general diffusion through our meadows, where we can obtain it without any trouble or expense.

BENJ. BURRELL.

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## METHOD OF PURIFYING COAL-GAS.

TO the methods mentioned in our last number in order to procure coal-gas in a sufficient degree of purity we may add the method invented by Mr. Edward Heard of London, which some years ago obtained in England a patent-right.

This invention may be thus described: lime is laid in strata with coals in a retort-stove or other close vessel, in which

they are placed for operation, or else the gas when produced in the common way is suffered to pass over lime previously laid in an iron or other tube or any other vessel adapted to the purpose and exposed to heat. After the gas has been conducted into a refrigeratory and all condensible matter is deposited, it is suffered to enter the conveying tubes and burnt in the usual manner. The reason for employing lime in preference to other substances is, that from a series of analytical experiments, Mr. Heard has detected the presence of sulphur in a great variety of the coals which are consumed in England, and he considers the suffocating smell so perceptible during the combustion of the gas obtained in the ordinary way, to arise from the products of that combustion, principally the sulphureous acid gas, which is then generated. "I present," says he, "lime in substance to the sulphur, as it is disengaged by heat from the coals, as it will, through their mutual affinity, arrest it in its progress, and form a sulphuret of lime or hydrosulphuret, depending on the circumstances of the operation. I have reason to conclude, that any of the fixed alkalies or alkaline earths, or carbonate of lime, when exposed to a degree of temperature sufficient to drive off the carbonic acid gas, might be substituted for lime; but from economical motives as well as from constant success, I prefer the agency of lime."—Mr. Heard wishes it to be distinctly understood, that lime, the alkaline earths, certain metals or their oxides, when mixed with the coals laid on their surface or put into separate vessels through which the gas is made to pass, are calculated in a greater or less degree to divest the gas of the cause of the offensive smell, but lime he reckons the best as well as the most convenient.

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### PROOF TO ASCERTAIN THE GOODNESS OF GUNPOWDER.

PLACE some gunpowder on a white paper and ignite it.—If it be good it will leave behind a pearly-grey spot. If there be too much coal in it, the spot will be black; and it will be yellow if there be too much sulphur. If there remain any residuum, it must be saltpetre, and in that case, the powder is not well beaten. If finally the paper be burnt, this is a decisive proof, that the powder is of a bad quality.

# POETRY.

## THE RETURN OF SPRING.

*From the Analectic Magazine.*

"Rise up, my love, my fair one, and come away. For lo the winter is past, the rain is over and gone: the flowers appear on the earth, the time of the singing of birds is come, and the voice of the turtle is heard in our land."

AWAKE, my beloved! my fair come away,
While the song of the grove hails the rising of day;
Lo! spring's blooming treasures enamel the lawn,
And the storms of dark winter are over and gone.

O sweet as thy breath is each zephyr that blows,
And bright as thy cheek is the blush of the rose;
And soft as thine accents of tenderness bland
Is the voice of the turtle-dove heard in our land.

Then come and I'll lead thee to close woven bowers,
Where the wild brook flows smoothly through margins of flowers;
Where the shy steps of love no intrusion need fear,
And its tender confidings no mortal can hear.

The wild brook shall dimple with pleasure and pride,
As thy beauties reflected are seen in its tide;
And the willow shall bend its fond branches so green,
To kiss the pure wave where thine image has been.

How sweet at this season to wander the grove
With the timid delays and fond loit'rings of love;
The murmuring whisper, the sigh half suppress'd,
And the quick glance withdrawn where the soul stands confess'd.

Alas, that the glories of morning should fly!
That the bud of the rose should just open and die;
That spring, the blest season of love, should depart,
And the voice of the turtle no more touch the heart!

Thus beauty decays—but returns never more!
And the spring time of youth—ah how soon is it o'er!
Then enjoy youth, and spring-time, and morn, while you may—
O rise, my beloved! my fair come away!

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[The following pungent and delicately managed sarcasm, is extracted from "THE STRANGER," a well conducted paper, published weekly at Albany.]

### To A——.

I DROVE from the dew-moistened breast of a rose
The fly that attempted its nectar to sip,
And I thought as I gaz'd on its delicate glow
That the bloom of its leaf was the blush of thy lip.

In a moment of fancy, I prest on its leaf
A kiss, like the one I bestowed upon thee!
But I felt, as I warmed its bloom on my lip,
That the fly and the snail had enjoyed it like me.

H.

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### SONNET.

AH! scenes remote! gray rock and mouldering tower,
And ivy-darkened dell, and shadowy stream:
Ye still are present in the musing hour,
And still ye mingle with my waking dream:
Not that remembrance culls her charmed theme
From thymy bank or honey-suckle bower:
A wanderer once did roam those vallies green,
Whose nymph-like steps amid the river dale
Would lingering pause: more lovely than the scene;
Her sweeter breath was blended with the gales:—
I bid yon distant haunts in mem'ry hail,
And sigh to muse the pleasures that have been!

## TO CHEERFULNESS.

BY W. SMYTH.

THE hunter on the mountain's brow,
The rosy youth from study free,
Ne'er breath'd, oh! cheerfulness, a vow
More fond, than I have breath'd to thee.
Yet sometimes, if, in lonely hour
I leave thy vow'd, enchanting bower,
By glooms of wayward fancy driven,
And from thee turn my languid eyes,
Nor longer deem thy pleasure wise,
Oh! be my suffering heart forgiven!
Not always can the varying mind
Bear to thy shrine an homage true;
Some chains mysterious seem to bind,
Some sullen sorrow to subdue:
Nor always can the scene be gay,
Nor blest the morning as to-day;
And ev'ning thought will sadness bring;
Can time so near me hourly fly,
Nor I this passing form descry,
Nor ever hear his rustling wing?
E'en now I feel with vain regret
How soon these happy days must end;
Already seems my sun to set,
I mark the shades of eve descend;
The vista catch, where sorrow grey
And weary pain are on their way;
Beyond with startled glance I see
The billows dark, the fated shore,
The forms that sink and rise no more
The ocean of eternity.